SCIENTIFIC AMERICAN

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THE PROPOSED NEW CROTON LAKE DAM AND THE NEW CROTON LAKE.

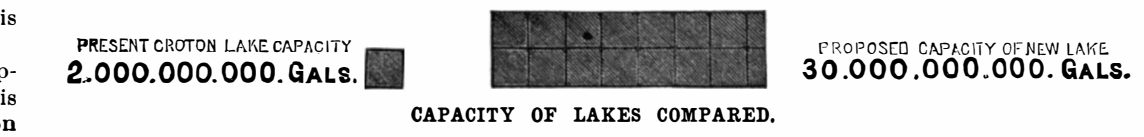
The New York Croton Aqueduct Commission, consisting of the Mayor, Comptroller, and Commissioner of Public Works, of the city of New York, and of four other commissioners, at a meeting held January 22, 1891, adopted a resolution for the preparation of plans for the construction of a dam upon the Croton River valley below the present Croton dam and at or near what is known as the Cornell site, a short distance above Quaker Bridge. The meaning of this resolution is that the construction of the famous Quaker Bridge dam is to be abandoned and a substitute therefor, situated some distance further up the stream, is to be built to provide additional storage capacity in the Croton River valley. The newly proposed dam is the outcome of a discussion in which different engineers took opposite views as to the future water supply of the city, and a compromise between the conflicting opinions is afforded by it.

For immediate water supply the city of New York is dependent on the old Croton dam. This structure, 400 feet long and 50 feet high, was in its day considered quite an engineering achievement. It is composed partly of earthwork and partly of masonry. The earthwork portion has no masonry core. It has its foundation upon hard pan, and in its construction a considerable amount of wooden cribwork was employed. As an additional provision for water supply several reservoirs are completed and in process of construction upon the upper branches of the Croton River; but these are to have no connection with the aqueduct except by way of the present Croton Lake. Their purpose is simply to impound water that would otherwise run to waste over the apron of the Croton dam.

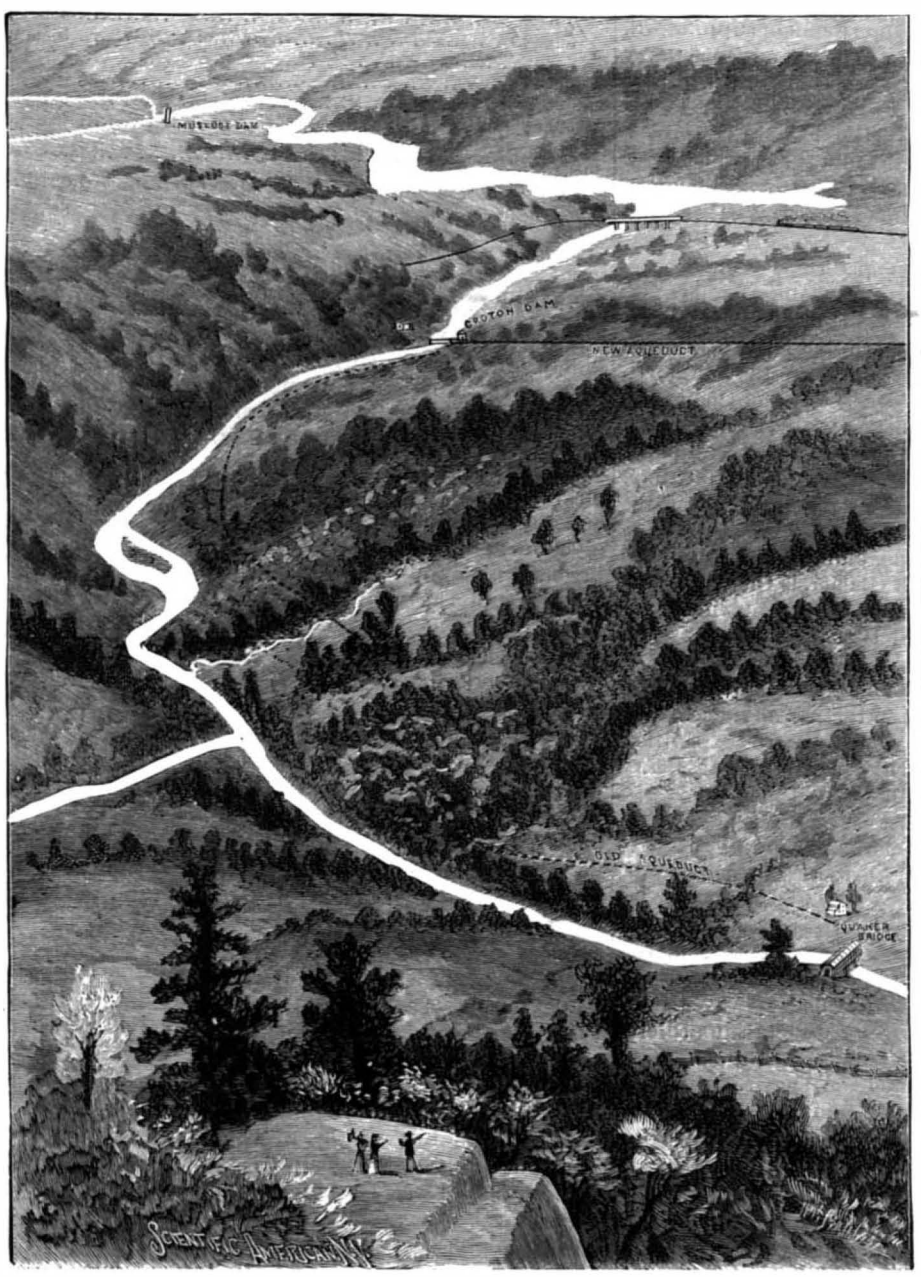
The absolute dependence of the city upon the original dam is thus made clear. If any accident were to happen to it, the supply of water would be at once cut off. The washing away of the South Fork dam, with the ensuing destruction of Johnstown, and the carrying away of many other dams before and since that memorable disaster, have occasioned some fears to be entertained for the safety of the Croton dam. It has stood intact for fifty years, and in all that time the water has never passed over the earthwork crest. Yet if this should occur, the dam would quickly be destroyed.

Estimates as to the rain fall that would be required to overtop the crest of the earthwork make it probable that a rainfall of nine inches, or even much less, under certain conditions, in twenty-four hours, would place the security of the dam in doubt. If the earthwork portion was washed away, it is probable that a part of the masonry would also succumb; but even if this did not happen, a gap one hundred and twenty-five feet long would be left, through which the flow of the river would pass, and New York would be without water until that gap could be filled. How long it would take to reconstruct this portion of the dam cannot be exactly stated. It is certain that it

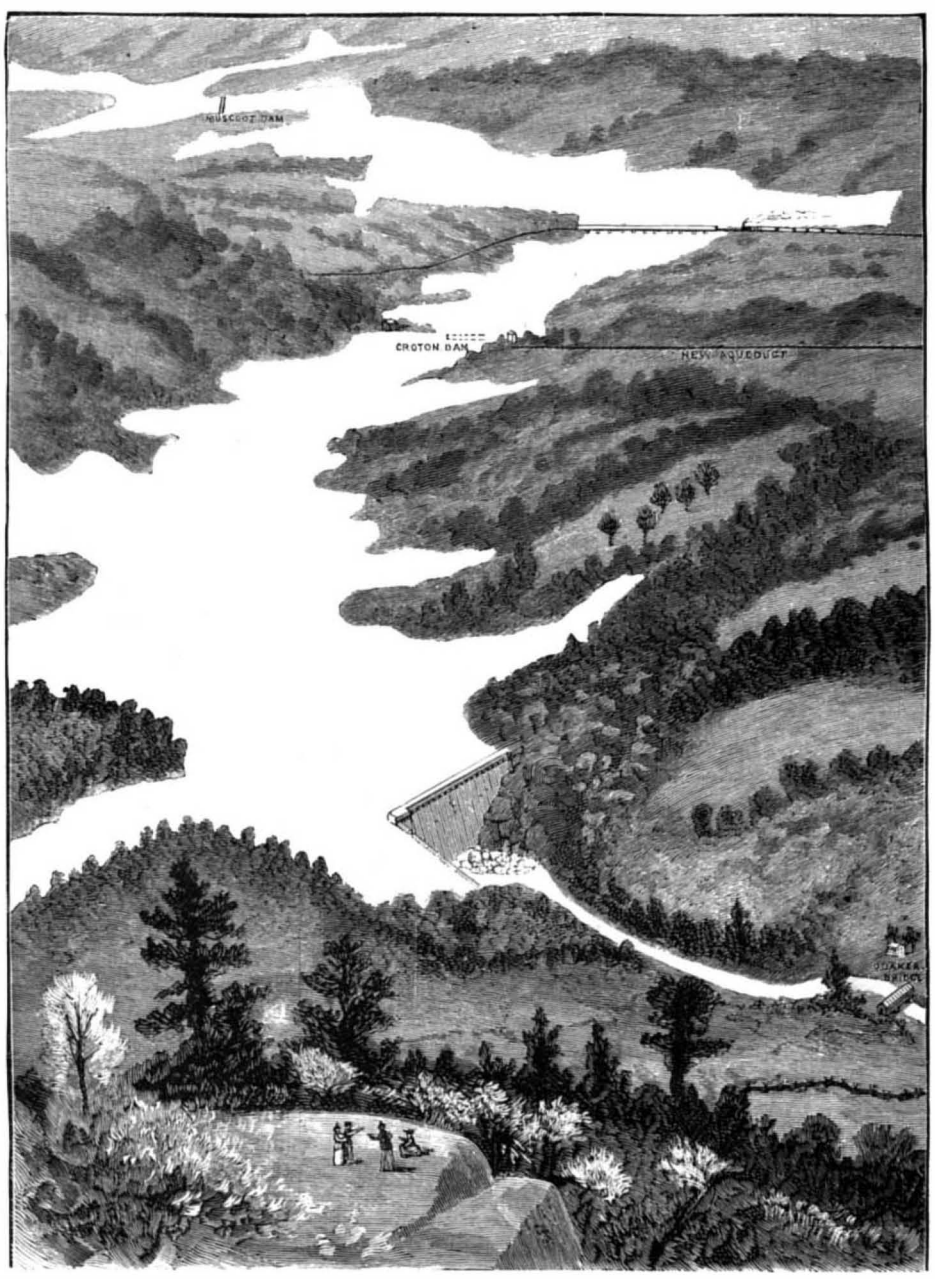
(*Continued on page* 389.)



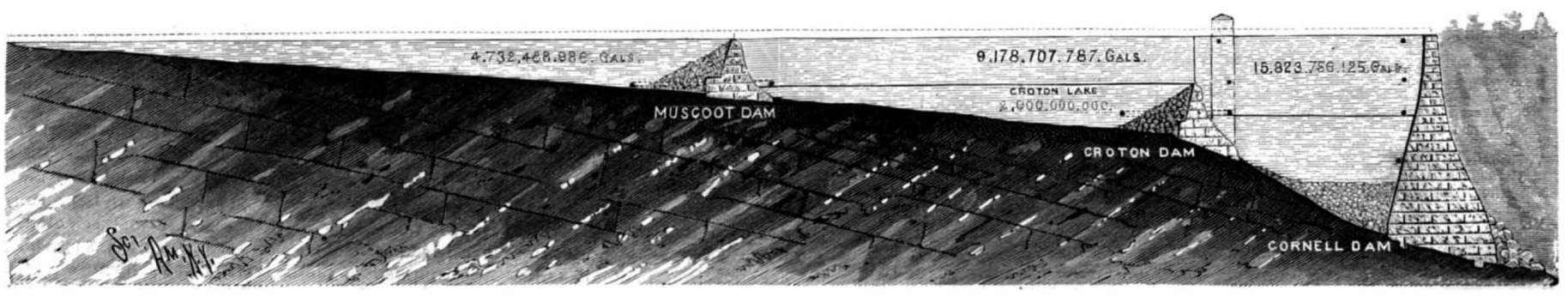
CAPACITY OF LAKES COMPARED.



PRESENT APPEARANCE OF CROTON RIVER AND LAKE.



LAKE FORMED BY PROPOSED DAM NEAR THE CORNELL SITE.



TRANSVERSE SECTION THROUGH NEW CROTON, AND MUSCOOT DAMS.

EXTENSION OF WATER SUPPLY SYSTEM FOR NEW YORK.

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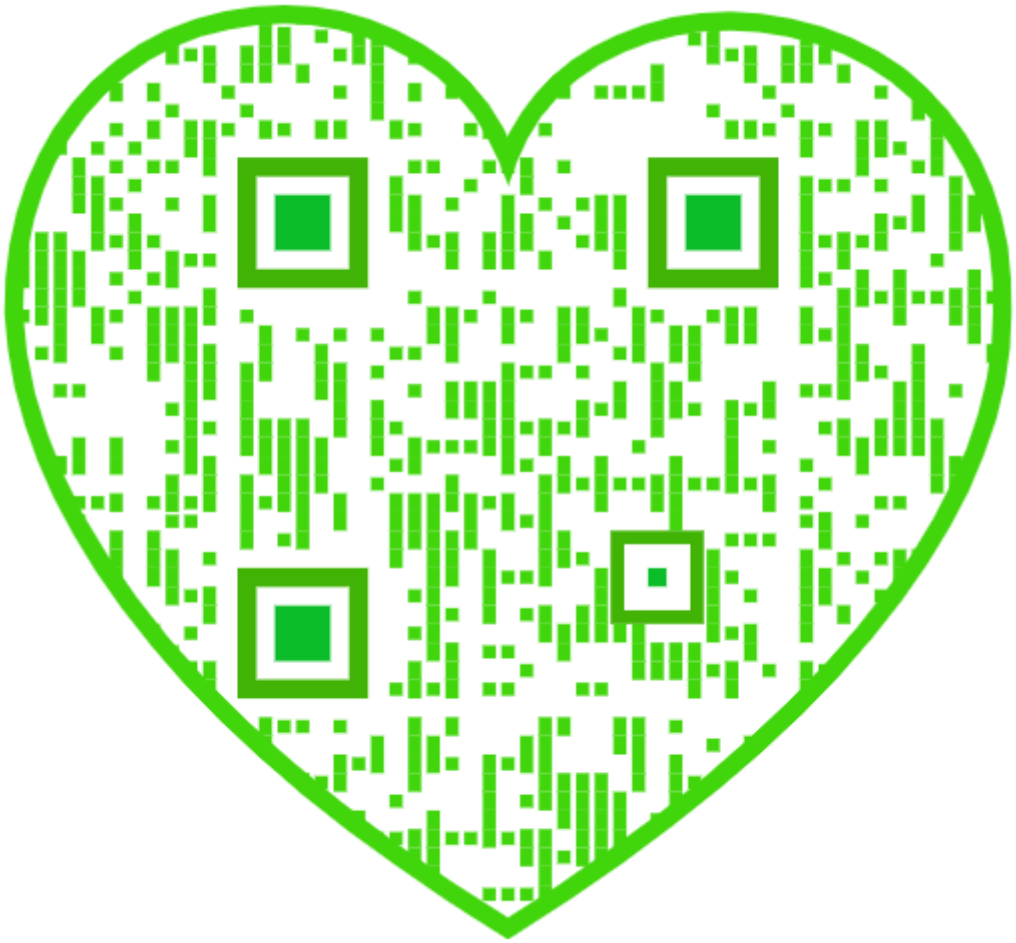

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THE SAILING OF TWO POLAR EXPEDITIONS.

In addition to the Greenland exploring expedition of Lieut. Peary, the sailing of which from New York was noted in our last issue, another expedition left Denmark the day following for the specific exploration of the east coast of Greenland, between 66° and 77° north latitude. The latter expedition is under the auspices of the Danish government, and is commanded by Lieut. Ryder, who intends to connect the surveys of Scoresby and the Koldewey expedition on the north with the discoveries of Capt. Holm on the south, completely outlining the east coast from Cape Farewell, its southern extremity, to Cape Bismarck in the north. Considerable difficulty is anticipated in reaching the coast where Lieut. Ryder expects to land, from the great ice fields almost constantly pressing against it. The party will consist of only five or six men, and it is designed to devote the fall season to the study of glacial phenomena, and the investigation of neighboring fiords with their glaciers. When the sledging period begins next spring, the explorer will start with sledges and boats to ascertain the outlines of the coast and study the edge of the inland ice, awaiting the arrival of a steamer to take him home about the latter part of next summer. If the vessel does not reach Ryder and his men, the party are prepared to spend the second winter in Greenland, retreating in the spring of 1893 to Cape Farewell and the Danish settlements of the west coast.

Lieut. Peary, in a communication published since his departure, gives some additional interesting details touching his plans for reaching the extreme north end of Greenland. After erecting a house on Whale Sound, near their landing, reconnoisances will be attempted across the great tongue of inland ice covering Prudhoe Land to the southern angle of Humboldt Glacier, where an advance depot for the main sledge journey will be established. In the spring the advance will be undertaken from Humboldt Glacier to the head of Peterman Fiord, where a second depot of supplies will be established, and from which point an advance party of two or three will push on with sledges, the others returning to Whale Sound. From the head of Peterman Fiord the route will be to the head of Grand Osborne Fiord, thence to the head of De Long Fiord, and thence to the northern terminus, from which it is intended to return by the same route to Whale Sound and await transportation home.

Lieut. Peary says of his expedition, "The whole theory of the project rests upon the now well established fact that the interior of south and middle Greenland is covered with an uninterrupted ice cap, and the more than probability (in my opinion) that in north Greenland the conditions are the same, and the ice cap nearly, if not quite, coextensive with the land. My personal impression is that the northern terminus of Greenland is not north of the 85° parallel of latitude, and that the inner ice cap is practically coextensive with the land, and this opinion is shared by Judge Daly and I think by most other eminent geographers." The base, near the Humboldt Glacier, is the one advocated by Kane, Hayes, Hall, and other eminent Arctic authorities, and it is expected that it will be possible to lay therefrom a straight course from point to point, without any "tidal cracks or chaos of heaped-up ice" to compel a long detour or stop further advance.

Besides Mrs. Peary, who accompanies the expedition to Whale Sound, the party will consist of Lieut. Peary and five men, as follows: John M. Verhoeff, of Louisville, Ky., aged 25, a mineralogist, and educated in an Eastern university; Dr. Frederick A. Cook, surgeon, aged 26, graduate of the College of Physicians and Surgeons and of the Univerity of the City of New York; Langdon Cook, Flushing, L. I., aged 26, member of the American Ornithologists' Union and member of the Brown-Stanton party in the Colorado Cañon survey of 1889-90; Eivind Astrüp, of Christiania, Norway, graduate of the Christiania Commercial College, an athlete, and especially skillful in ski-running; Matthew Hensen; Virginia, 23 years of age, colored. All possess first class physique, with exceptionally high lung power, and are men of diversified attainments, especially selected for the task in hand.

These two expeditions, with the auxiliary party from the Philadelphia Academy of Natural Sciences, going with Peary to Whale Sound to make scientific collections on the west coast, are almost certain to add very materially to our knowledge of Greenland, if they do not furnish any conclusive information as to the existence or non-existence of an open polar sea. The exploration of the Arctic Zone in its entirety, with its laws of aerial and oceanic currents, is a work to which it is hoped these expeditions, with their apparently moderate and practicable scope, will largely contribute.

Enforced Temperance.

The *Nation* says: "The agency of the railroad companies in promoting temperance is not generally appreciated. They employ 689,912 persons, not counting those who mine the coal and iron, make the rails or locomotives, or build the cars and carriages used by the road. The freight and passenger traffic of the country is practically controlled by 600 of these corporations, and of these 600 no fewer than 375 prohibit the use of intoxicating liquors by their employes, among the number being most of the largest companies. The Brotherhood of Locomotive Engineers uses its influence in the same direction. 'Whenever a member of the order is known to be dissipated,' says Mr. Arthur, long the head of the organization, 'we not only expel or suspend him, but notify his employers,' and during the last year 375 members were expelled for this cause. This is only one illustration of the way in which practical business considerations are operating to promote the spread of temperance. It is purely a matter of business with the railroad companies. They simply cannot afford to employ a man who is liable any day to get drunk and precipitate some terrible disaster. The average man thus comes to see that it is 'money in his pocket,' in more senses than one, if he keeps out of the saloon; and the moral is not lost upon him."

Fastest Average Time across the Atlantic.

The White Star steamship Majestic completed a voyage on June 10 that would have been the best on record from Queenstown if she had gone over the same course traversed by the City of Paris when she made her record run of 5 days 19 hours and 18 minutes. The Majestic took a long southerly course of 2,850 miles to avoid ice and fog. Her time was 5 days 22 hours and 20 minutes, and her average speed per hour was 20·023 knots. This is the best recorded hourly average ever made by an ocean steamship. Over the record course of 2,788 knots her time would have been about 5 days, 19 hours and 4 minutes, or 14 minutes better than the record of the City of Paris. The Majestic's daily runs, from noon to noon, a period of about twenty-four hours and fifty minutes, were:

	Miles.
June 4.....	441
June 5.....	501
June 6.....	497
June 7.....	501
June 8.....	502
June 9, to the Sandy Hook Lightship.....	408
Total.....	2,850

The Majestic brought 1,005 steerage and 395 cabin passengers.

An Explosive Mixture.

Dr. John Grant writes to the *Lancet* as follows:

Having occasion to make a disinfectant fluid to apply to an offensive surface on a body awaiting post mortem examination, I chanced to select permanganate of potash. Thinking the solution might dry too quickly and inefficiently deodorize the part, it occurred to me to add glycerine on account of its hygroscopic powers. Putting a drachm of the crystals into a three ounce bottle, I added two ounces of water and one of glycerine, and agitated the mixture. To my great surprise the cork and part of the contents were violently ejected, and the remaining portion developed great heat. Every one is familiar with the danger of mixing glycerine and nitric acid; I have not, however, seen any mention of a combination of it and permanganate of potash. I observed the mixture became brown, losing its purple color like a deoxidized solution of the salt; and as no effervescence took place, it is probable that the glycerine combined with the oxygen liberated by decomposition of the salt, and that, further, it possesses by some affinity of its own the power of producing rapid decomposition of the permanganate. Perhaps some chemist will kindly explain.

Tempering Tools.

The following is said to be the Swiss method of hardening cast steel for cutting tools. Mix in a suitable vessel four parts of pulverized resin and two parts of train oil. Stir well in this one part hot tallow. Into this mixture the article to be hardened is plunged at a low red heat and held there until thoroughly cooled. Without cleaning off, the piece is again put into the fire and suitably tempered in the ordinary way. An examination of steel thus hardened indicates that the hardening is deeper and more uniformly distributed than is commonly the case, and that the steel is less brittle. Articles thus hardened have excellent and durable cutting qualities.—*Stone.*

The Lick Observatory—A Change in the Staff.

James E. Keeler, who has been associated as an astronomer with the Lick Observatory ever since that institution was opened, will now have charge of the astronomical work at the Allegheny Observatory, where Professor Langley was stationed before his removal to Washington. He served at Allegheny under Professor Langley some years ago, and ascended Mount Whitney with that distinguished scientist in 1881. He has made spectroscopic work his specialty. Mr. Campbell, of the University of Michigan, will fulfill part of the duties performed by Mr. Keeler at the Lick Observatory.

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Condensed Information Concerning Some of the More Valuable Insecticides.

KEROSENE EMULSION.

This insecticide acts by contact and is applicable to all non-masticating insects (sucking insects, such as the true bugs and especially plant lice and scale insects and also to many of the mandibulate insects when the use of arsenites is not advisable. Kerosene emulsion may be made by means of various emulsifying agents, but the most satisfactory substances and those most available to the average farmer and fruit grower are milk and soapsuds. In each of these cases the amount of emulsifying agent should be one-half the quantity of kerosene.

One of the most satisfactory formulas is as follows:

		Per cent.
Kerosene	2 gals.	67
Common soap or whale oil soap	½ lb.	33
Water	1 gal.	

Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force pump and spray nozzle for 5 or 10 minutes. The emulsion, if perfect, forms a cream which thickens upon cooling and should adhere without oiliness to the surface of glass. For use against scale insects dilute one part of the emulsion with nine parts of water. For most other insects dilute one part of the emulsion with fifteen parts of water. For soft insects like plant lice the dilution may be carried to from 20 to 25 parts of water.

The milk emulsion is produced by the same methods as the above.

THE RESIN WASHES.

These insecticides act by contact, and also, in the case of scale insects, by forming an impervious coating which effectually smothers the insects treated. These resin washes vary in efficacy according to the insect treated. Experience has shown that the best formula for the red scale (*Aonidia aurantii* Maskell) and its yellow variety (*A. citrinus* Coquillett) is as follows:

Resin	18 lb.
Caustic soda (70 per cent strength)	5 "
Fish oil	2½ pts.
Water to make	100 gals.

The necessary ingredients are placed in a kettle and a sufficient quantity of cold water added to cover them; they are then boiled until dissolved, being occasionally stirred in the meantime, and after the materials are dissolved the boiling should be continued for about an hour, and a considerable degree of heat should be employed, so as to keep the preparation in a brisk state of ebullition, cold water being added in small quantities whenever there are indications of the preparation boiling over. Too much cold water, however, should not be added at one time, or the boiling process will be arrested and thereby delayed, but by a little practice the operator will learn how much water to add so as to keep the preparation boiling actively. Stirring the preparation is quite unnecessary during this stage of the work. When boiled sufficiently it will assimilate perfectly with water, and should then be diluted with the proper quantity of cold water, adding it slowly at first and stirring occasionally during the process. The undiluted preparation is pale yellowish in color, but by the addition of water it becomes a very dark brown. Before being sprayed on the trees it should be strained through a fine wire sieve, or through a piece of Swiss muslin, and this is usually accomplished when pouring the liquid into the spraying tank, by means of a strainer placed over the opening through which the preparation is introduced into the tank.

The preparing of this compound will be greatly accelerated if the resin and caustic soda are first pulverized before being placed in the boiler, but this is quite a difficult task to perform. Both of these substances are put up in large cakes for the wholesale trade, the resin being in wooden barrels, each barrel containing a single cake weighing about 375 pounds, while the caustic soda is put up in iron drums containing a single cake each, weighing about 800 pounds. The soda is the most difficult to dissolve, but this could doubtless be obviated by first dissolving it in cold water and then using the solution as required. This insecticide may be applied at any time during the growing season.

A stronger wash is required for the San Jose scale (*Aspidiotus perniciosus* Comstock), and the following formula gives the best results:

Resin	30 lb.
Caustic soda (70 per cent)	9 "
Fish oil	4½ pts.
Water enough to make	100 gals.

Place all the ingredients in a kettle and cover with water to a depth of 4 or 5 inches, boil briskly for about 2 hours or until the compound can be perfectly dissolved with water. When this stage is reached, the kettle should be filled up with water, care being taken not to chill the wash by adding large quantities of cold water at once. It may be thus diluted to about 40 gallons, the additional water being added from time to time as it is used.

This preparation should only be applied during winter or during the dormant period. Applied in the growing season, it will cause the loss of foliage and fruit.

In the application of both these washes a very fine spray is not essential, as the object is not simply to wet the tree, but to thoroughly coat it over with the compound, and this can be best accomplished by the use of a rather coarse spray, which can be thrown upon the tree with considerable force.

FOR SUBTERRANEAN INSECTS.

Recent experiments have shown the practical value of the resin compounds against the grape phylloxera, and they will also be applicable to the apple root louse and other underground insects. The cheapest and at the same time one of the most satisfactory compounds experimented with is the following:

Caustic soda (77 per cent)	5 lb.
Resin	40 "
Water to make	50 gals.

Dissolve the soda over fire with 4 gallons of water, add the resin, and after it is dissolved and while boiling add water, slowly, to make 50 gallons of compound. For use dilute to 500 gallons. Excavate basins about the vines 6 inches deep and about 2 feet in diameter, and apply to each vine 5 gallons. The results will be more satisfactory if the treatment is made early in the spring, so that the rain of the season will assist in disseminating the wash about the roots.

The kerosene emulsion made according to the formula given above is also applicable to certain underground insects in cases where it will not prove too expensive, as, for instance, the grape phylloxera or where white grubs are infesting a valuable lawn. It may then be used in the proportion of 1 part of the emulsion to 15 gallons of water, applied liberally to the soil, and afterward washed down at frequent intervals with large quantities of water for several days. This can be done only where there is plenty of water at hand, but will be found of great value in special cases.

In other cases bisulphide of carbon may be used for specific and local underground forms. Nests of ants, for instance, may be destroyed by pouring an ounce of this substance into several holes, covering them with a wet blanket for ten minutes and afterward exploding the vapor at the mouth of the holes with a torch. Against onion, cabbage, and radish maggots this substance may also be used, by punching a hole with a sharp stick at the base of the plant and pouring in a teaspoonful of the liquid, covering afterward with earth.

THE ARSENITES—LONDON PURPLE, PARIS GREEN, AND WHITE ARSENIC.

These poisons are of the greatest service against all mandibulate insects, as larvæ and beetles, and they furnish the most satisfactory means of controlling most leaf feeders, and the best wholesale remedy against the codling moth. Caution must be used in applying them on account of the liability of burning or scalding the foliage.

The poisons should be thoroughly mixed with water at the rate of from 1 pound to 100–250 gallons water, and applied with a force pump or hand spray nozzle. In preparing the wash it will be best to first mix the poison with a small quantity of water, making a thick batter, and then dilute the latter and add to the reservoir or spray tank, mixing the whole thoroughly. When freshly mixed, either London purple or Paris green may be applied to apple, plum, and other fruit trees, except the peach, at the rate of 1 pound to 150–200 gallons, the latter amount being recommended for the plum, which is somewhat more susceptible to scalding than the apple. White arsenic does little if any injury at the rate of 1 pound to 50 gallons of water. As shown by Mr. Gillette, however, when allowed to remain for some time (two weeks or more) in water, the white arsenic acts with wonderful energy, scalding when used at the rate of 1 pound to 100 gallons from 10 to 90 per cent of the foliage. The action of the other arsenites remains practically the same, with, perhaps, a slight increase in the case of London purple.

With the peach these poisons, when applied alone, even at the rate of 1 pound to 300 or more gallons of water, are injurious in their action, causing the loss of much of the foliage.

By the addition of a little lime to the mixture, London purple and Paris green may be safely applied, at the rate of 1 pound to 125 to 150 gallons of water, to the peach or the tenderest foliage, or in much greater strength to strong foliage, such as that of the apple or most shade trees.

Whenever, therefore, the application is made to tender foliage or when the treating with a strong mixture is desirable, lime water, milky, but not heavy enough to close the nozzle, should be added at the rate of about 2 gallons to 100 gallons of the poison.

Pure arsenic, however, should never be used with lime, as the latter greatly increases its action.

With the apple, in spraying for the codling moth, at least two applications should be made—the first on the falling of the blossoms, the apples being about the size of peas, and the second a week or ten days later; but the poison should never be applied after the fruit turns down on the stem, on account of the danger of the poison collecting and remaining permanently in the stem cavity.

For the plum curculio on the plum, cherry, peach, etc., two or three applications should be made during the latter part of May and the first half of June; in the case of most leaf feeders, spray on the first indication of their presence.

CAUTION NECESSARY IN THE USE OF THESE INSECTICIDES.

The relative susceptibility of apple, plum, and peach has just been indicated under the head of arsenical poisons, and these remarks apply equally well to the uss of the kerosene emulsions. In the case of other plants thorough experiments are still necessary, and all insecticides should be first used in comparatively high dilution. In general, it may be said that tender young foliage is more susceptible and must be carefully treated. Thin-leaved pilose plants are more readily injured, while thick-leaved, glabrous species are least affected. Annual plants, such as cabbages and other garden vegetables, are more susceptible than perennials, but in the case of root crops, such as beets, turnips, radishes and potatoes, there is not the same need of caution as to damage to foliage. Damage to foliage is not shown at once, and in case of rain following an application, another application should not be made for several days. Fruit trees should not be sprayed with arsenical poison before the blossoms fall, on account of the danger of poisoning honey bees. —*Circular U. S. Depart. Agriculture.*

Furniture Polishes.

A Red Polish.

Oil of turpentine	16 oz.
Alkanet	4 drachms.
Beeswax	4 oz.

Digest the alkanet in the oil until sufficiently colored; then scrape the beeswax fine and form a homogeneous mixture by digestion over a water bath.

For a pale polish omit the alkanet.

A White Polish.

White wax	1 lb.
Solution of potash	32 oz.

Boil to proper consistency.

Polish for Fine Carved Wood.—Take 8 oz. of linseed oil, 8 oz. of old ale, the white of an egg, 1 oz. of spirit, 1 oz. of spirits of salt. To be well shaken before using. A little is to be applied to the face of a soft linen pad and lightly rubbed for a minute or two over the article to be restored, which must afterward be polished off with an old silk handkerchief. This will keep any length of time, if well corked.

For Delicate Cabinet and Papier Mache Work.

Linseed oil	32 oz.
Spirit	8 "
Vinegar	8 "
Butter of antimony	2 "
Oil of turpentine	8 "

Shake well before using, and apply with a woolen rubber.

Oil of turpentine	16 oz.
Rectified oil of amber	16 "
Olive oil	16 "
Oil of lavender	1 "
Tincture of alkanet	4 drs.

Mix.

A cotton rubber is saturated with this polish, which is thus applied to the wood. The latter is then well rubbed with soft, dry cotton rags and wiped dry.—*Meyer Bros.' Druggist.*

How Granite Columns are Turned.

Granite for columns, balusters, round posts, and urns is now worked chiefly in lathes, which, for the heaviest work, are made large enough to handle blocks 25 feet long and 5 feet in diameter. Instead of being turned to the desired size by sharp cutting instruments, as in ordinary machines for turning wood and metal, granite is turned or ground away by the wedge-like action of rather thick steel disks, rotated by the pressure of the stone as it slowly turns in the lathe. The disks, which are six or eight inches in diameter, are set at quite an angle to the stone, and move with an automatic carriage along the lathe bed. Large lathes have four disks, two on each side, and a column may be reduced some two inches in diameter the whole length of the stone by one lateral movement of the carriages along the bed. The first lathe for turning granite cut only cylindrical or conical columns, but an improved form is so made that templets or patterns may be inserted to guide the carriages, and columns having any desired swell may be as readily turned. For fine grinding and polishing the granite is transferred to another lathe, where the only machinery used is to produce a simple turning or revolution of the stone against iron blocks carrying the necessary grinding or polishing materials.

Blocks are prepared for lathe work by being roughed out with a point, and by having holes chiseled in their squared ends for the reception of the lathe dog and centers. This principle of cutting granite by means of disks revolved by contact with the stone has been also applied to the dressing of plain surfaces, the stone worked upon being mounted upon a traveling carriage and made to pass under a series of disks mounted in a stationary upright frame.—*Census Report.*

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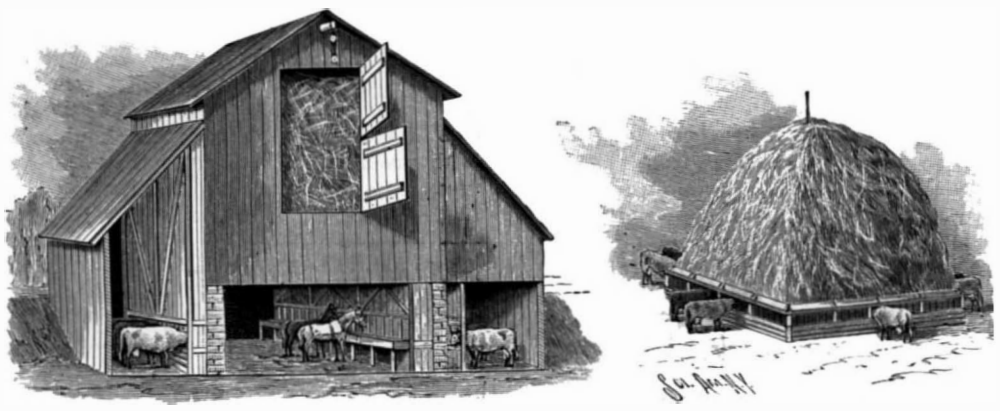
AN IMPROVED FEED RACK, BARN, ETC.

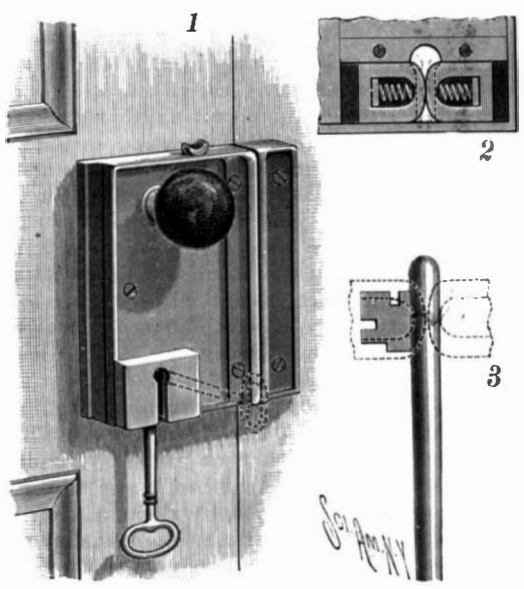
The illustration represents an improved construction of feed racks and sheds, applicable also in connection with a barn, in which a self-regulating feed receiver operates in conjunction with a protected feed-saving manger, with a regulating slide in the rack, the shed affording an economical and efficient protection for the stock against storms. This improvement has been patented by Mr. Samuel H. Warren, of Keosauqua, Iowa. The rack has a self-regulating feed receiver in its upper part, by which the feed is conveyed to the manger beneath, the receiver working automatically, while facilities are afforded for the self-regulating and keeping back of feed as desired.



WARREN'S FEED RACK, CATTLE SHED, AND STOCK BARN.

The lower girts, guards and supports of the feed rack are fastened by bolts to vertical supports, upper girts and braces being also secured thereto, while slats nailed to the upper and lower girts constitute the feed receiver. The rack is made smaller at the top than at the bottom, permitting the feed to spread and become somewhat loosened, so as to be more easily drawn out. Retaining stakes are secured at their tops at the upper portion of the manger, and extend obliquely downward toward the center of the rack below the receiver, the stakes keeping the material back from the manger while permitting the animal to draw the hay out, and the hay accumulating in the bottom of the manger is thus protected from being trampled upon by the cattle. Horizontal slides are kept in place by cleats nailed to the top of the manger, and by guards. In the rack and shed combined the roof of the shed is centrally supported by the vertical posts of the rack, the slats of which run up to the roof of the shed, while the walls of the shed extend sufficiently beyond the rack to protect cattle feeding thereat, afford room for cleaning and bedding, and also a convenient driveway.

With such a shed and feed rack, it is designed that sufficient feed will always be kept in place to last for several days, without wasting, preventing the necessity of having to look after the stock during the prevalence of storms. With such a construction adapted to a barn, as shown, the capacity of the barn is greatly increased, in the matter of sheltering and caring for stock as well as for the storage of feed. The cattle can also be cared for with great facility, instead of, as



DOOR LOCK.

is often the case, it being more trouble to get the hay to them than it was to get the hay into the barn in the first place. The feed rack and manger for horses is a modification of the cattle rack, intended to prevent waste of the hay, and a double portable rack of this kind is designed to be well adapted for the outdoor feeding of horses and colts, either combined with the model shed or independently thereof. A portable pen rack is made in sections like the barn rack, but without the feed receiver. It is designed to be set up around a stack or rick of hay, and can be readily secured in position, without much regard to the condition of the ground. A large sheep feed rack, intended to be combined with the model shed, is designed to hold a large supply of hay where the feed can be reserved for emergencies, the rack holding enough, if desired, to last for several weeks. All these racks, except the pen rack, are designed to be self-regulating, and their construction is comparatively simple and inexpensive.

Copper Sulphate as a Fungicide.

"The various compounds of copper offer efficient protection to many cultivated crops against the exceedingly destructive ravages of fungous parasites. Without treatment, these rots, rusts, mildews, and blights frequently destroy a large proportion of, or even the entire, products of fields and fruit plantations. The applications, in the shape of watery sprays, are made so readily, and with so little expense in money and labor, that every one interested should at once undertake the work. The practical results already attained constitute the greatest advance made in recent times in the application of science to horticulture. A little well directed effort may be confidently expected to return a hundred or a thousand times its cost. Still there is need for much vigilance and careful attention to every detail. Mistakes may be made even then, and sometimes failures may occur, for which existing knowledge may offer no explanation. But we should persevere, gain all possible information upon the subject, and watch well the effects in every test. In this way, every one may hope to conquer, practically, these insidious and, heretofore, invincible foes." Such are the conclusions after numerous experiments made by Dr. Burrill, of the Illinois Agricultural Station.

A LOCK WITH KEY HELD PENDENT.

A lock in which the key is held so that it cannot fall out when the door is slammed, while preventing also the introduction of a skeleton key, is shown in the accompanying illustration. Furthermore, when the door is opened against the wall it does not injure the plaster. It has been patented by Mrs. Virginia M. Hollyday, Baltimore, Md. The case, bolt, and tumbler of the lock are of the usual construction, except that the case has an external chamber around the keyhole, as shown in Fig. 1. On the inner side of this chamber, as shown in Fig. 2, is a key clamp composed of two spring jaws which press toward each other upon opposite sides of the keyhole. These jaws slide in guides on the case, and are placed far enough from the plane of rotation of the key bit so as not to be in the way of the bit in revolving to throw or withdraw the bolt. The keyhole is also continued through the bottom of the case, to permit the key to be swung down into a vertically pendent position, Fig. 3 showing how the shank of the key is then held by the spring jaws. After the bolt is thrown, the key is turned so that its bit is in a horizontal plane, when it is partly pulled out and swung down, the clamping jaws then closing behind its shank, and the keyhole being obstructed so that another key cannot be introduced.

Gas Properties not Injured by Electricity.

In a circular recently issued to the shareholders of the Standard Gas Light Company, of this city, we find it stated that President Andrews, at the last annual meeting asserted, that statistics proved that the growth of gas consumption in New York City, for forty years prior to the introduction of electricity for lighting purposes, averaged about ten per cent per annum. That is, the gas output doubled every ten years, and that the city had doubled in population every seventeen years. Since the first introduction of the electric light, however, the increase in New York of the consumption of gas has been much more rapid. It almost immediately jumped up to twelve per cent per annum, and in 1887 showed a growth equal to about fourteen per cent per annum, a ratio of growth that was still further exceeded in the years 1888–89–90. In fact, he was willing to stand by the statement that the gas output of New York was doubling itself now in a period of six and one-half years, instead of ten years, as before. He thought one reason for this very rapid increase was due to the fact that the electric light had educated the human eye "in the aggregate" for a demand for more light, and that people are not at all satisfied with the volume of light that formerly satisfied them. Again, a more luxurious mode of living is constantly prevailing in the city, as in all great cities, which is shown in the great increase in the use of gas for cooking and heating purposes. In conclusion, President Andrews thought it was safe to say that at no time in the history of the gas industry, from its beginning in this country some sixty odd years ago to the present time, has the outlook been more promising. Indeed, at no time has it been so inviting for the investment of capital as at present, and it may be stated as a settled fact that the electric light, at least in New York City, is not at all a competitor with gas to the injury of the latter.—*The American Gas Light Journal.*

AN EXTENSIBLE BARREL TRUCK.

The illustration represents an extension frame and combination platform truck, especially adapted to move heavy goods, and barrels of liquid which may be open or covered, there being no danger of spilling the contents of open barrels. The frame of this truck is adjustable, the axle being made in sections that interlock by means of a bolt and nut arrangement, whereby the wheel base may be widened to accommodate barrels of different size. A swiveled caster wheel is used in front, the frame being hung just high enough to clear thresholds and similar obstructions. This truck is made with a strong oak platform that can be readily removed when desired, there being on the bottom of the platform a strong iron button which clutches into the V-shaped frame of the truck, holding the platform securely in position. To remove the platform, it is raised by the rear end and pulled backward, being thus detached from the frame, the truck then being

CLARK'S BARREL TRUCK.

better suited for some forms of factory and store use. These trucks are manufactured in various sizes, with iron and with rubber-tired wheels, by George P. Clark, Windsor Locks, Conn.

Steel Pipes.

The Steel Pipe Company, of Kirkaldy, have done something toward showing the advantages possessed by steel over wrought iron pipes. It is stated by Mr. D. J. Russell Duncan, Assoc. M. Inst. C. E., that wrought iron or steel pipes can be produced at a less cost per unit of length than cast iron pipes. A pipe built of steel can be made at a less cost of labor than one of wrought iron, on account of the reduction in the number of plates and rivets, and, therefore, of calking and punching. Being less liable to corrosion than pipes of wrought or cast iron, the durability of steel is insured. It is stated by one authority that the best precaution is to have the pipes galvanized, then coated with natural asphaltum or with a composition of pitch, tar, petroleum, linseed oil, and chalk. This solution is heated in a bath to a temperature of 250°, and the pipes immersed till they acquire the same temperature as the composition. The pipes should also be coated as they are laid in the trench. As regards strength, the steel pipe is much superior to glazed stoneware or cast iron, or about three and a half times stronger than the latter. Mr. Duncan says: "As steel is on an average 1·3 times stronger than wrought iron, it is clear that for pipes of equal strength of plate, and allowing that the riveted or welded seams are of equal strength on both, the thickness of mild steel need only be about 0·77 of the thickness of wrought iron." This economy of material can be effected by using open hearth mill steel of the highest possible tensile strength.

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IMPROVED WIMSHURST STATIC ELECTRICAL MACHINE.

The former construction of the Wimshurst machine is shown by working drawings in SCIENTIFIC AMERICAN SUPPLEMENT, No. 548. The present is a simple improvement by which peculiar results are obtained. It is described by *Engineering* as follows:

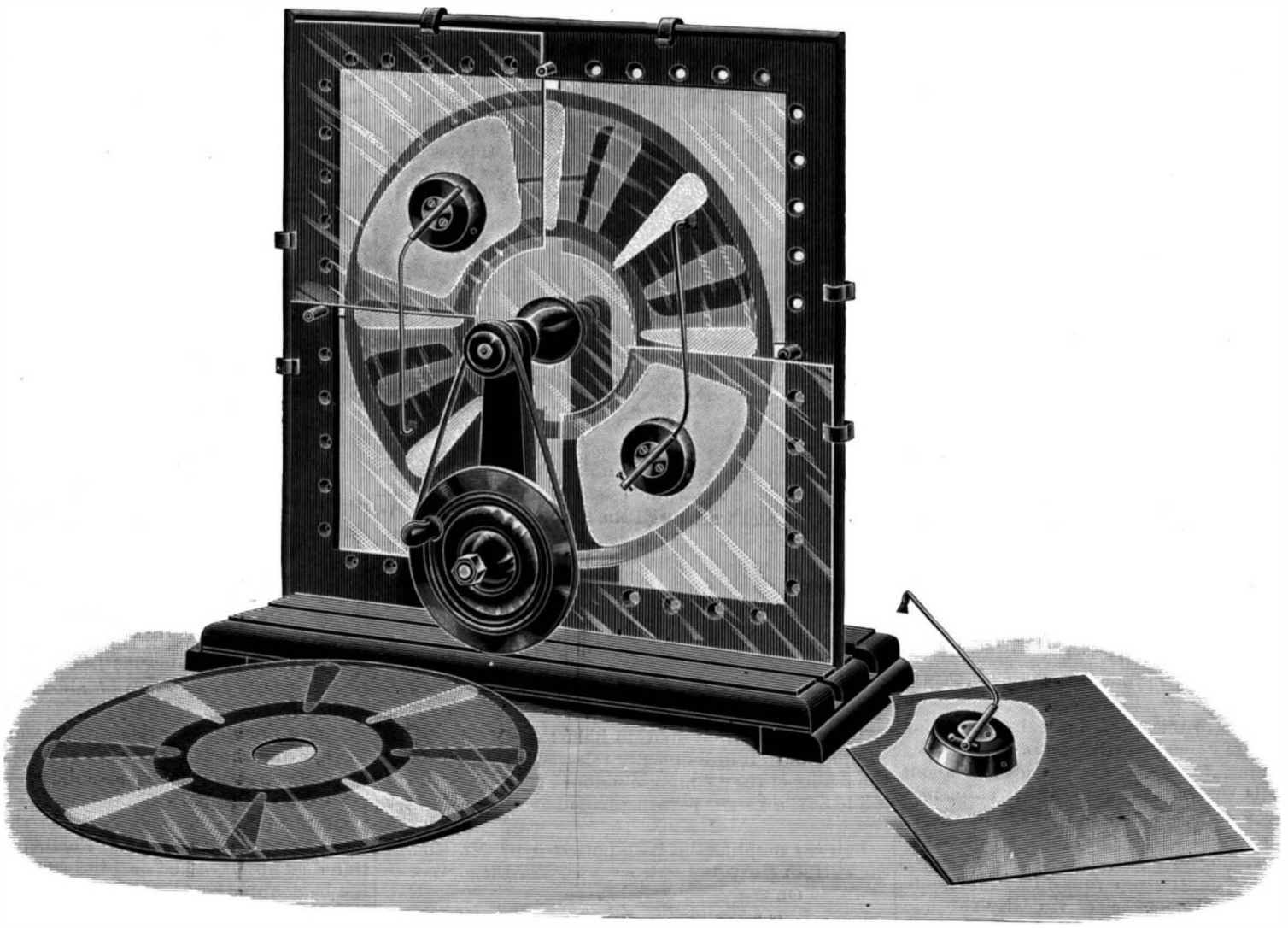
Among the various machines which have been constructed for the generation of statical or so-called frictional electricity, none can be compared with that of Mr. James Wimshurst, of the consultative staff of the Board of Trade, London, either for simplicity, reliability, or efficiency. These merits of the Wimshurst influence machine are known to a very wide circle of electricians and physicists; consequently the news that the inventor has brought out another, having very curious and unlooked for qualities, will be received with interest and expectation in many laboratories, schools, and homes, and will secure for it an attentive reception, which its remarkable features fully justify. The new apparatus was lately exhibited for the first time before the Physical Society.

A remarkable feature of the new machine is that while it gives an abundance of sparks, it is impossible to charge a Leyden jar, or similar contrivance, from it. After the electricity has been apparently flowing for minutes into the jar in rapid sparks, the latter is found to be free from all charge. Neither spark nor shock can be obtained from it, and delicate tests fail to reveal the presence of electricity in it. It is as if one had been pumping water into a bucket with no bottom; the stream is plainly to be seen, but nothing accumulates. It is, however, easy to demonstrate the integrity of the jar, and its capacity to hold a charge when filled from an ordinary machine. The conclusion is therefore forced upon us that the current of sparks is really the oscillation of a small charge, which flows backward and forward with great rapidity between the machine and the jar. The electricity that is developed is alternately positive and negative, and the normal condition of the jar is not upset.

If we investigate the action of the machine more minutely by the aid of an electroscope of an exceedingly delicate construction, we find confirmation of the hypothesis that positive and negative electricity is produced alternately. Commencing to turn the disk exceedingly slowly, say at the rate of three or four revolutions per minute, the leaves of the electroscope suddenly diverge, being repelled from each other. They remain apart quite steadily until the disk has made rather more than three-quarters of a revolution, when they suddenly approach and cling together, showing that the sign of their charge has changed. They remain thus for an instant, and during another three-quarters of a revolution they again separate, and so on. But if the disk be turned rapidly the leaves are no longer able to respond in this way to the changes of charge. Such light appliances, with their large surfaces exposed to the air, are incapable of rapidly approaching and receding through a considerable distance under the small stresses brought to bear upon them. They consequently take up a mean position between the extreme ends of the range, and show the alternate attractions and repulsions to which they are subject, by a quick fluttering or tremor. It is abundantly evident that they are subject to varying stresses, which the retarding effect of the atmosphere will not allow them to completely obey.

The appearance of the machine is clearly shown in the engraving. A central spindle carries a glass disk 16 in. in diameter. This is varnished, and has affixed to it a number of sectors of tinfoil. The sectors measure 4 in. radially, while in breadth they may vary from ¼ in. to 5½ in. Usually the sectors on one side of the disk are arranged to break joint with those on the other side, but this is not essential. Indeed, in many respects the construction of the machine is very elastic, and many modifications are introduced. For instance, the number of tinfoil sectors may vary from 2 to 16 or more, on each side, and as we have said, their relative positions on the two surfaces of the disks are not important. The disk itself is mounted in the center of and in the same plane as a wooden frame 20 in. square. This frame carries four inductors of the shape shown in the detached view; they are 9¾ in. square, with one corner cut away to admit the spindle and boss of the disk. Two of the inductors are mounted on each side of the frame, at opposite diagonal corners; those at the side of the machine nearest the spectator are, say, at the upper left hand and the lower right hand corners. At the opposite side the inductors are at the upper right hand and the lower left hand corners. Upon each inductor plate is a tinfoil patch of the shape shown, measuring 4 in. radially and 7 in. circumferentially. Other inductors are provided, having upon them the smallest tinfoil patch practicable. Cemented over each patch is a wooden disk which on its face carries a bearing in which there rides a bent brass rod, having a plume of fine wires at its end, touching the glass disks at a point 90 deg. remote from the inductor, and opposite one of the inductors at the other side of the plate. The disk is thus touched on both sides in two places. It is driven by a cord from a small handwheel below, and revolves in the direction of the hands of a clock. To further vary the capabilities of the machine a bar of insulating material is made to carry two metal wire plumes at its ends, these having metallic connection with two terminals; this device takes the place of two of the inductors and by its use a constant flow of electricity may be maintained.

The machine which we illustrate has been constructed with the view of being most readily used for the purpose of demonstration and experiment. It is provided with several disks, having different arrangements of sectors, and all the parts are made interchangeable. By withdrawing the rear bearing the nut on the spindle can be screwed off at once, when half the boss comes away and the disk can be withdrawn and be replaced by another in a few moments. The inductors lie on pegs on the square frame, and are held by light steel clips; provision is made by a number of holes in the frame for the use of inductors of different sizes. To couple one inductor to another, if such an arrangement should be desired, holes are bored in the wooden disks carrying the brush holders, and into these holders the ends of wires can be inserted, the wires being bent in such a way to join any pair of inductors. The parts of the machine are beautifully finished, and all the ends are attained by the simplest devices. The method of action of this instrument is not very easy to follow, and indeed no theory has yet been put forward in explanation of the results which flow from it.



THE WIMSHURST ALTERNATING INFLUENCE MACHINE.

Curious Electrical Phenomenon.

Some remarkable electrical phenomena accompanying the production upon a large scale of solid carbon dioxide are described, says *Nature*, by Dr. Haussknecht, of Berlin, in the current number of the *Berichte* of the German Chemical Society. In order to obtain large quantities of solid carbonic acid, it is found most convenient in practice to allow the liquid stored in the usual form of iron cylinder to escape into a stout canvas bag. The liquid issues at pressures varying from 60 to 80 atmospheres, and a compact snow-like mass of solid carbon dioxide is formed in the canvas receiver. When the experiment is performed in the dark, the canvas receiver is seen to be illuminated within by a pale greenish violet light, and Dr. Haussknecht states that electric sparks 10 to 20 cm. long dart out from the pores of the cloth. Dr. Haussknecht further states that the phenomenon is very noticeable in the dark, whenever there is a leakage in any portion of the compressing apparatus or the manometers connected therewith. The reason assigned for this development of statical electricity is similar in principle to that usually accepted in explanation of the hydro-electric machine of Sir William Armstrong. As the liquid carbonic acid is issuing from the valve, it becomes partly converted into gas, which is violently forced through every pore of the canvas. Moreover, carried along with this stream of gas are great quantities of minute globules of liquid, which are brought in forcible contact with the solid particles already deposited. Dr. Haussknecht, therefore, considers that the electrical excitation is due mainly to the violent friction between these liquid globules and the solid snow. It is very essential for the successful reproduction of these electrical phenomena that the carbon dioxide should be absolutely free from admixed air; that prepared artificially yielding much finer results than that obtained from natural waters, which latter contains considerable quantities of air. The luminosity is not generally developed in the interior of the receiver until a crust of solid carbonic acid 0·5 to 1 cm. thick has been deposited, which renders the probability of the correctness of the above theory all the greater.

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Correspondence.

To Fish Broken Screw Shafts.

To the Editor of the Scientific American:

Observing an article in your issue of the 6th inst., "Mending a Big Shaft at Sea," in which mention is made of the Thompson coupler as a means of fishing broken screw shafts, I wish to say that this coupler was devised by me in April, 1881, and a sketch of it published in the *Mechanical Engineer* of that date. The article is too long to quote here, but reference thereto will show you that it is the same thing which Mr. Thompson, an English engineer, invented some years later. It is now carried on most English ships.

EGBERT P. WATSON.

New York, June, 1891.

To the Editor of the Scientific American:

In your paper of the 6th instant, under the head of "Great Tower of the City Hall, Philadelphia, Total Height 547 Feet," you say, "The total height, when completed, will be 547 feet 2½ inches, and will only be surpassed in this respect by the Eiffel Tower and the Washington Monument, which surpasses it by less than three feet." The last part of this statement is not correct, as the Washington Monument is 555 feet high, and, therefore, it is 7 feet 9½ inches higher than the tower of the City Hall at Philadelphia.

I take great pleasure in reading your paper, and I am always glad when Friday comes, so that I can receive my paper. Yours respectfully,

H. H. MILLER.

1625 Thirty-second St., Washington, D. C., June 5, 1891.

The Wonderful Redwood Forests of the Pacific Coast.

To the Editor of the Scientific American

About two years ago I made a visit to the Pacific coast, and being engaged in the manufacture of saws, I took a steamer for Humboldt Bay and stopped at Columbia City, this being the headquarters of the redwood kings. Major Vance, being an old customer of mine, invited me to mount his donkey engine and ride some 8 or 10 miles and see the redwood forest and their manner of cutting and getting the logs to their mills. Upon our arrival at the terminus of the road we clambered down through the roughness of the unbroken ground to the very edge of the vast mammoths of the Pacific. Said I, "How large is this forest?" "Well," said my friend, "it is about eighty miles through it to Oregon, and it is over one hundred miles in length, and will average over 200,000 feet of lumber to the acre." I will not stop to figure this up, but will let the reader make an estimate of the number of feet of timber it contains.

But this is not the only redwood forest on the Pacific coast by any means.

The underbrush is so thick and dense that few living things ever venture among the redwoods. No grizzly bears inhabit these forests. Near the ground about every redwood is shaken and slit, so they chisel into the tree up say 6 to 8 feet high and wedge in a piece of small joist and build a staging, then clamber up, and with narrow, long crosscut saws saw them down in winter; then, when the sap runs in spring, go in and peel off the thick bark, some of it nearly two feet thick, and trim or cut the thick bushes, and in the dry season set fire and burn up what they can. Then it is in shape to run a railroad track in and get the timber.

At the terminus of Mr. Vance's road there were two or three donkey engines at work, one 8 ox team (four yoke of oxen), another team of six large mules, all with blocks and falls, getting a log 16 feet long and about 10 feet through on to a car for the saw mill. I was told that this one log would weigh about 18 tons. Just on a sloping piece of ground were shattered redwood strips, and some teams and a gang of men getting out the shattered pieces and roots, some with blocks and falls, and piling them up and trying to burn them off, and this was a slow job, as redwood is very difficult to burn. I said, "Mr. Vance, what in the world are you trying to do here?"

Said he, "Well, I have been trying to experiment in raising French prunes on a small patch, and I succeeded very well, so I am clearing off a 100 acre plot, and have ordered 200,000 dozen plants from France, and am going to try that first."

"But this experiment will cost you some money," said I.

"Oh, not more than $200,000," said my friend.

I afterward learned that my friend was worth over $3,000,000, all made out of redwood timber.

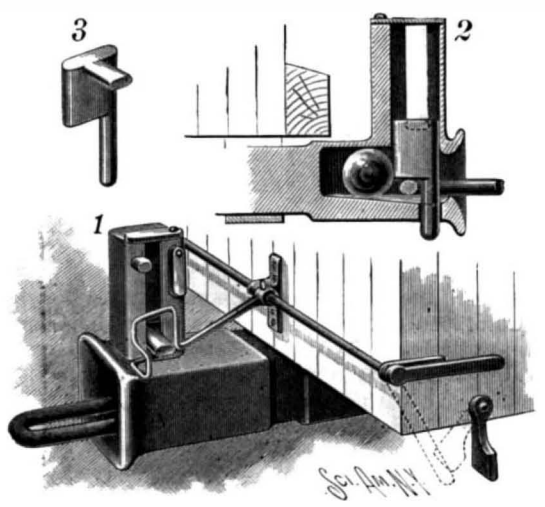
J. E. EMERSON.

Beaver Falls, Pa., June, 1891.

THE only proper way to keep a gun barrel in good order is to wash it out with boiling hot water, dry with linen swabs and oil with vaseline or cylinder oil, every time that it is used. It should never be laid aside unattended to for a day or two after firing.

AN IMPROVED CAR COUPLING.

The illustration represents a coupling device designed to hold the link in extended position, or hold the pin elevated, as desired, for coupling with an approaching car, the coupling being automatically effected as the cars come together. Fig. 1 is a perspective view showing the application of the device, Fig. 2 showing a section through the drawhead, and Fig. 3 representing the coupling pin detached. Near the flaring edge of the lower wall of the drawhead is a cup-shaped depression forming a seat for the arrest of a steel ball which rests and rolls in a longitudinal channel extending back from the seat, the ball not leaving the drawhead. Near the front end of the drawhead is a vertical oval passage adapted to loosely receive the coupling pin, sliding in a guide box, an arm or limb projecting from one side of the pin through a slot in the guide box. The coupling pin lifter has a rectangular loop adapted to engage this arm of the pin, a hub at the other end of the pin lifter being adjustably secured on a transverse shaft journaled on the end of the car, the shaft having hand levers adapted to be operated from either side of the car. When the coupling pin is fully elevated, it may be locked in such position, if desired, by a latching engagement of a dog with the hand lever, as shown in dotted lines, but if the lever is released after being raised, the coupling pin then rests on the ball, which rolls by gravity into the cup-shaped depression. By the entrance of a link, when the parts are in this position, the ball is pushed backward and the pin drops, thus effecting the coupling. Fig. 2 represents the manner in which the parts are arranged to support a link in horizontal position for automatic coupling with an approaching car. Near the top of the slotted side of the guide box is pivoted a latch, which may be used independently



STEWART'S CAR COUPLING.

of the pin lifter if desired to hold the pin in elevated position until it is designedly released, and to prevent the lifting of the coupling pin above the surface of the guide box, a keeper plate is pivoted at the top of the slot.

This car coupling has been patented by Mr. Elmore Stewart, of No. 601 Milton Avenue, San Diego, Cal.

How Insulators are Made.

A writer in the recent issue of the *Tradesman* gives the following description of the manufacture of insulators as carried on by one of the factories in the South:

Steatite is the material out of which is made a long list of goods used by almost all classes of people, and which have become almost indispensable.

Seward's patent lava electric insulators are so well known to all electricians of the world, and their superior excellence so universally acknowledged, that all persons, whether electricians or not, will be interested in knowing something of the process of manufacture. The crude material, as it is received from the mine, is as uninteresting as any other pile of rocks, which it seems to be, and to the uninitiated it would seem to be a hard task to produce anything from it which would be of any use to any one. The first process is that of reducing the rock to powder, which is done by passing it through an ordinary stamp mill, such as is used for reducing gold and silver ores; it is then carried by chain conveyor to the mills proper, where it is ground to an impalpable powder, then conveyed by elevators to the bolts, where it passes through the finest silk bolting cloth, and is deposited in large bins or settling chests, whence it falls to the lower floor again, and is thence taken to the mixing tubs, which revolve, and stir the mass of material with chemicals in combination until it resembles dough for bread. It is then passed to the rolls, where it is repeatedly pressed, the same as if for crackers. The next machine is a peculiar double-acting press, used for forming the charges for the hydraulic press. The latter machine is the only one of its kind ever built, and is the subject of several patents. Its capacity is something wonderful; it can make 200,000 slate pencils or 1,000 gross dustless school crayons in a single day's run. It makes the pressed blanks from which the lava insulators are made in any diameter required by simply changing the die. Tubes for insulators are also made on this machine, and are meeting with great success for interior or underground work, as they are not only absolutely fireproof, but they cannot be damaged by rats, as the insulation on the ordinary wire, and when once placed in position they are almost everlasting.

The Origin of Meteorites.

In former times it was thought that meteorites were of terrestrial origin, thrown out by volcanoes, or condensed vapors, or else that they hailed from the moon.

These suppositions do not hold good when we consider the enormous initial velocity, the great number, direction and periodical recurrences of these phenomena. For the same reasons, is it impossible that they should be fragments of a destroyed satellite—a second moon—supposed to have revolved around our planet in past ages, or yet that they are diminutive, independent planets of our solar system.

The hypothesis that they are identical with shooting stars and comets is the one accepted almost universally by scientific men.

Most important discoveries tending to prove this assumption were made by Schiaparelli, showing that shooting stars, as well as meteorites, are solid bodies, which enter the atmosphere of our earth with an immense velocity and become luminous because of the resistance offered by the air.

It has been calculated that they usually appear at a height of about seventy miles above the earth and disappear at a height of fifty miles. The cause of their disappearance or extinguishing is to be looked for either in their once more leaving our atmosphere, or that they are atomized by the fierce heat generated by their extremely rapid flight and the great resistance offered by the atmosphere. The latter assumption would account for the continuous fall of cosmic dust upon the surface of our globe.

The velocity with which they enter and pass through our atmosphere is enormous. It is many times faster than sound, the flight of a cannon ball, and even the planets revolving around the sun.

The earth travels through space at the rate of 19 miles per second. Mercury, the fastest planet, covers 29·87 miles per second, while a meteorite which fell at Pultusk, Russia, had a velocity of 33·78 miles per second, although it had to overcome the resistance of the air. In space, consequently, it must have traveled still faster.

To clearly understand the high degree of velocity implied by these figures, it is well to add that the fastest cyclone scarcely reaches 150 feet per second, at which rate it exerts a pressure of about fifty pounds per square foot.

It now remains to explain the assumption that meteorites and shooting stars are identical, and to quote the facts upon which this assumption is based.

We know that both are solid bodies which enter our atmosphere from without, and that they become luminous for the same reason. Furthermore, the cosmic iron dust observed in localities where its origin could not be doubted has been found to have the same chemical composition as larger pieces of meteoric iron seen to fall by unimpeachable witnesses.

It cannot be denied that there is a very great contrast between the little star that silently glides through space and noiselessly disappears and the terrifying appearance of a ball of fire, that, approaching with deafening detonations, sends down on us a hail of stones.

Both spectacles, however, are but the extremes of a chain of closely connected phenomena. Considering with what extreme velocity these bodies pass through the atmosphere, it is not difficult to comprehend that particles, and those having the greatest momentum, are destroyed long before they reach the earth, and at such a height that the noise of their passage and disintegration becomes inaudible to us here below.

We find a further confirmation for the belief that both of these phenomena have the same source in the well established fact, proved in many instances, that the direction of the meteorites corresponds to that of shooting stars observed at the same time, and points to a common point of radiation.

The detonations accompanying the fall of a meteorite have three distinct causes: The whizzing is caused by its rapid passage through the air; the crackling, by the combustion of the materials composing it; and the thundering, by columns of air rushing into the vacuum which it leaves behind.—*F. C. Von Petersdorf, in Great Divide.*

WHEN the mosque of St. Sophia, in Constantinople, was built, more than one thousand years ago, the stone and brick were laid in mortar mixed with a solution of musk, and the building it is said has been infected with the odor ever since. Probably age has imparted a musty odor, from which the musk story was fabricated.

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THE PROPOSED NEW CROTON LAKE DAM AND THE NEW CROTON LAKE.

(*Continued from first page.*)

would be a work of time—rather of weeks or of months than of a few days.

If the Quaker Bridge dam were built, the present Croton dam would be submerged beneath 34 feet of water, and would cease to be an element in the water supply of the city. Mr. A. Fteley, chief engineer of the Croton Aqueduct Commission, recognizing the possibility of failure of the Croton dam, and the requirement of additional storage, proposed the construction of a dam about one mile below the site of the present Croton dam. This structure, owing to the contour of the country and the nature of the subsoil, would be far less expensive than the Quaker Bridge dam. It would retain a much smaller quantity of water, and would but slightly increase the present watershed. But by making its crest correspond in level with the crest of the proposed Quaker Bridge dam, the present watershed would be far more thoroughly utilized, and Mr. Fteley calculated that such a dam would provide for the wants of the city for thirty years to come, and that the saving in cost over the Quaker Bridge dam would, with the associated saving in interest charges, represent enough money to build the larger structure if even then it should be required, thus giving the city two dams instead of one for the same cost.

After much discussion and the rendering of different reports, the compromise structure situated in the vicinity of the Cornell site was determined upon. As a matter of interest the following data may be examined, showing the relations of the abandoned Quaker Bridge project and of the proposed Cornell site dam:

Location.	Extreme Height above River Bed.	Extreme Depth below River Bed.	Extreme Total Height.	Length of Dam between Flow Lines.	Capacity in Gallons.	Estimated Cost.			Probable Time of Construction.	Watershed above Dam.
						Dam Proper.	Railroads, Roads, Bridges, and Clearing.	Muscoot Dam, as Previously Estimated.		
	Feet.	Feet.	Feet.	Feet.					Years.	Sq. Miles.
Quaker Bridge.....	180	91	271	1,402	34,000,000,000	$4,087,000	$1,075,000	$300,000	6	377·8
Cornell's.....	159	70	229	1,736	30,000,000,000	3,650,000	1,075,000	300,000	5	376·3

Should either dam be built, the proposed Muscoot dam must be built also, in order to preserve as far as possible a uniform level in the limits of the town of Crotona.

In this connection it should be noted that the dam proposed by Mr. Fteley, to be constructed about a mile below the present Croton dam, would have cost, if partially made of earthwork, but $1,750,000, and would have provided for a storage of 16,000 millions of gallons.

The necessity for the new dam is not only due to the possible insecurity of the present structure. An immense quantity of water goes to waste over the Croton dam, owing to the area of the watershed tributary to it. During the dry season of 1890 a rain storm occurred after much water had been drawn from the storage basins. Yet the single rain fall was enough to produce a heavy waste, which, at a rate of over 600 millions of gallons per day, flowed over the Croton dam. The same shower produced but little increase in the upper reservoir. In other words, we are really losing the advantage of much of the best portions of the Croton River watershed. The area lying between the upper storage basins and the Croton dam is very insufficiently utilized.

The present Croton Lake is a long, narrow body of water, suggesting in its appearance a wide river. The Cornell dam will change all this and will create a wide and long lake of great size. The large illustration shows the condition of things at this time contrasted with the features to be established by the creation of the proposed new storage basin. In place of the present Croton Lake, with its capacity of about 2,000 millions of gallons, and of the insignificant stream from its overflow, an immense wide sheet of water appears extending far back into the country, submerging Croton dam and part of the line of the old aqueduct and extending a long distance back of the Muscoot dam site. The sectional drawing shows the relative heights and capacities of the elements of the proposed new system. The vertical measurements, it will be understood, are necessarily greatly exaggerated in this cut, its object being to present to the eye the whole situation at a glance. The relative capacities of the present and of the proposed Croton Lake are about as 1 to 15, as shown on the small cut.

Referring again to the sectional drawing, it will be seen that in place of the limited storage, about two thousand millions of gallons, of the old Croton Lake, an available storage of some twenty-four thousand millions of gallons is provided below Muscoot dam. A large body of water must always remain at the lower levels below the outlets which will be unavailable. The by-pass of Muscoot dam will, in case of necessity, enable its body of impounded water to be made a part of the rest, giving an aggregate of thirty thousand millions of gallons available for the city.

Tracing the lines of the Croton River and its tributaries, the two most remote reservoirs of the old supply are the "Boyd's Corners" and "Middle Branch," respectively. These represent a watershed of 43·76 square miles. The new dam on the Cornell site will represent a watershed of 332·52 square miles. In area this is 22·28 square miles in excess of the watershed tributary to the present Croton dam. But the advantage due to its greater height in rendering possible a fuller utilization of this great area is the point strongest in the favor of the new dam.

The selection of the Cornell site in preference to the Quaker Bridge site is due to a full examination of the country. An extensive series of drill holes, aggregating 14,005 lineal feet in length, together with test pits and trenches, have been made to determine the location of the country rock. At the Cornell site the rock is 123 feet below the surface, an advantage of nearly 40 feet over the Quaker Bridge site. The side hills from the point of view of imperviousness seem superior to those at Quaker Bridge. The dam may be made partly of earthwork, and its construction is recommended on that basis. The watershed is only one and one-half square miles less than at Quaker Bridge.

Concrete Walls and Piers.

Mr. T. Martin says that some substances, such as pozzuolana—a volcanic production found chiefly in Italy—have, in consequence apparently of silicate of alumina being predominant in their composition, the property of giving hydraulic qualities to the rich or non-hydraulic limes. It is of these that the concrete is made which has long been used for marine works on the shores of the Mediterranean, and, indeed, the piers at some of the Italian ports have been constructed almost entirely of hydraulic concrete. The author had lately an opportunity of examining at Genoa the extension of one of the moles of the harbor, the inner side of which has a vertical wall. The latter was in process of being constructed under water entirely of pozzuolana concrete, simply thrown into the sea from baskets carried on men's heads, a boarding confining it to the shape of the wall. In a short period it set quite hard, so as to enable the upper part of the wall, which is of stone, to be built upon it. The outer side of the mole, which had been previously made, was formed by stones deposited "a pierre perdue." Though the depth of the quay wall was not great, this shows the confidence which the Italian engineers have in concrete applied under water in a soft state. The piers of the new basin constructed by the Austrian government at Pola, in Istria, are also formed, in a similar manner, of concrete confined between rows of timber piling.

But perhaps the most striking application on a large scale of pozzuolana concrete is in the great mole which protects the port of Algiers. To form the mole, blocks of beton of immense size, so as to be immovable by the force of the sea, were employed. Some of these were formed *in situ*, by pouring the concrete into large timber cases without bottoms, sunk in the sea in the line of the mole. Other blocks of a smaller size, though upward of 30 tons in weight, were made on shore, being moulded in strong wooden boxes. After the beton had set, the boxes were removed, and the blocks were launched into the sea to find their own level. The beton for the blocks *in situ* was composed of one part of rich lime in paste, two parts of pozzuolana, and four parts of broken stone; that for the blocks made on shore was formed of one part of lime in paste, one part of pozzuolana, one part of sand, and three parts of broken stone. These blocks set sufficiently hard in twenty-four hours to resist the shocks of heavy seas, and the mole now stands firmly, instead of being, as it was when formed of loose blocks of stone in the time of the Moors, nearly destroyed every winter.

The French engineers have shown great boldness and skill in the application of beton. as exemplified in the Pont de l'Alma over the Seine, the arches of which, as well as the piers, are formed of rubble concrete, in the new graving dock at Toulon, before alluded to, and in the formation or protection of breakwaters by enormous artificial blocks of beton, as carried out at Marseilles, Cherbourg, La Ciotat, Cette, Vendres, Cassis and Algiers. A short time ago, when the author inspected the mole or breakwater which incloses the harbor of Marseilles, he found the huge rectangular concrete blocks, weighing upward of 20 tons each, by which its seaward side is protected on the "pierre perdue" principle, perfectly entire and sharp in their outline, though they have been exposed for many years to the action of the sea. Any one standing upon that mole, and witnessing in a gale the heavy seas breaking with tremendous force on these concrete masses and recoiling harmlessly, could have no doubt as to the efficiency of concrete as a constructive material.

Hydraulic concrete, to be effective, requires care and attention in its manipulation, and in the regulation of the proper proportions of its materials. Any failures must have arisen from inattention to these or similar points, as there is ample experience to show that, when properly made, every confidence may be placed in its strength and durability. Even where stone is abundant, this material may be often employed with economy and advantage, but where stone cannot be obtained, the importance of being able to form an effective substitute out of materials of so little value, and so widely distributed, can hardly be overrated.

Lime Sulphate.

This substance is one of the most annoying and injurious of all those held in solution by water used for making steam. Some waters, especially those from limestone districts, contain it in such large quantities that its use in boilers becomes a real source of danger. The peculiarity about this substance is that the colder the water, the more of it will be held in solution, and this is not the case with a great number of substances which are soluble in water, for the higher the temperature, the more will be dissolved and held in suspension by the water. Water of ordinary temperature may hold as high as 7 per cent of lime sulphate in solution, but when the temperature of the water is raised to the boiling point, a portion of it is precipitated, leaving about 0·5 of 1 per cent still in solution. Then as the temperature of the water is raised, still more of the substance is precipitated, and this continues until a gauge pressure of 41 pounds has been reached, which gives a temperature of about 290 degrees. At this point all the sulphate of lime has been precipitated. Many other scale-forming substances act in a similar manner.

This shows quite plainly that any temperature that can be produced by the use of exhaust steam would not be sufficient to cause the precipitation of all the substances which might be contained in the water. But the highest temperature that can practically be obtained from the use of exhaust steam would be about 250 degrees; and this is far above the average practice, as to obtain this temperature a back pressure of about 14 pounds would be required, so it will be seen that the water still contains a sufficient amount of sulphate of lime and other matter to cause a perceptible amount of scale to form in the boiler. Most of the substances which go to form boiler scale follow a similar law in this respect, so that nearly all of them are precipitated from solution when the temperature reaches that point due the pressure of steam commonly carried, but in some cases even that is not sufficiently high to cause the total precipitation of all such matter, but the conversion of water into steam leaves these salts free, and as the water can hold no more in solution, they are precipitated in the form of granules or dust and kept in circulation in the water until they find an eddy and become deposited in some part of the boiler, or as the boiling ceases, the water still retaining its temperature, the sediment settles on the top of the tubes and on the boiler plates, from which place only a portion of it is dislodged when the boiling again takes place. Some of these substances when alone form a hard crystalline scale, while others are deposited as loose matter, and still other substances when they are deposited together combine and form a different kind of scale. As the greater proportion of these scale-forming substances are precipitated when the water is at a very high temperature, it would seem quite natural that they might be removed or prevented from entering the boiler by the use of a live steam heater. This it is asserted is the case where such devices are in use.—*G. H. West, in Stationary Engineer.*

A NOVEL plan for extinguishing a church debt has been hit upon in Melbourne. The church committee—or vestry, as the case may be—divide the total debt among themselves and each man insures his life for the amount that falls to his share. The policies are transferred to the church, and the annual payments on them are made out of the collections. Then, of course, as the members of committee "drop off," the sums insured on their lives drop in, and later, when the last committeeman is dead, the last installment of the church debt will be paid. The plan has the merit—if merit it be—of throwing the whole of the responsibility for the continuance of the indebtedness upon Providence.

SULPHATE or chloride of zinc dissolved in water is a good disinfectant.

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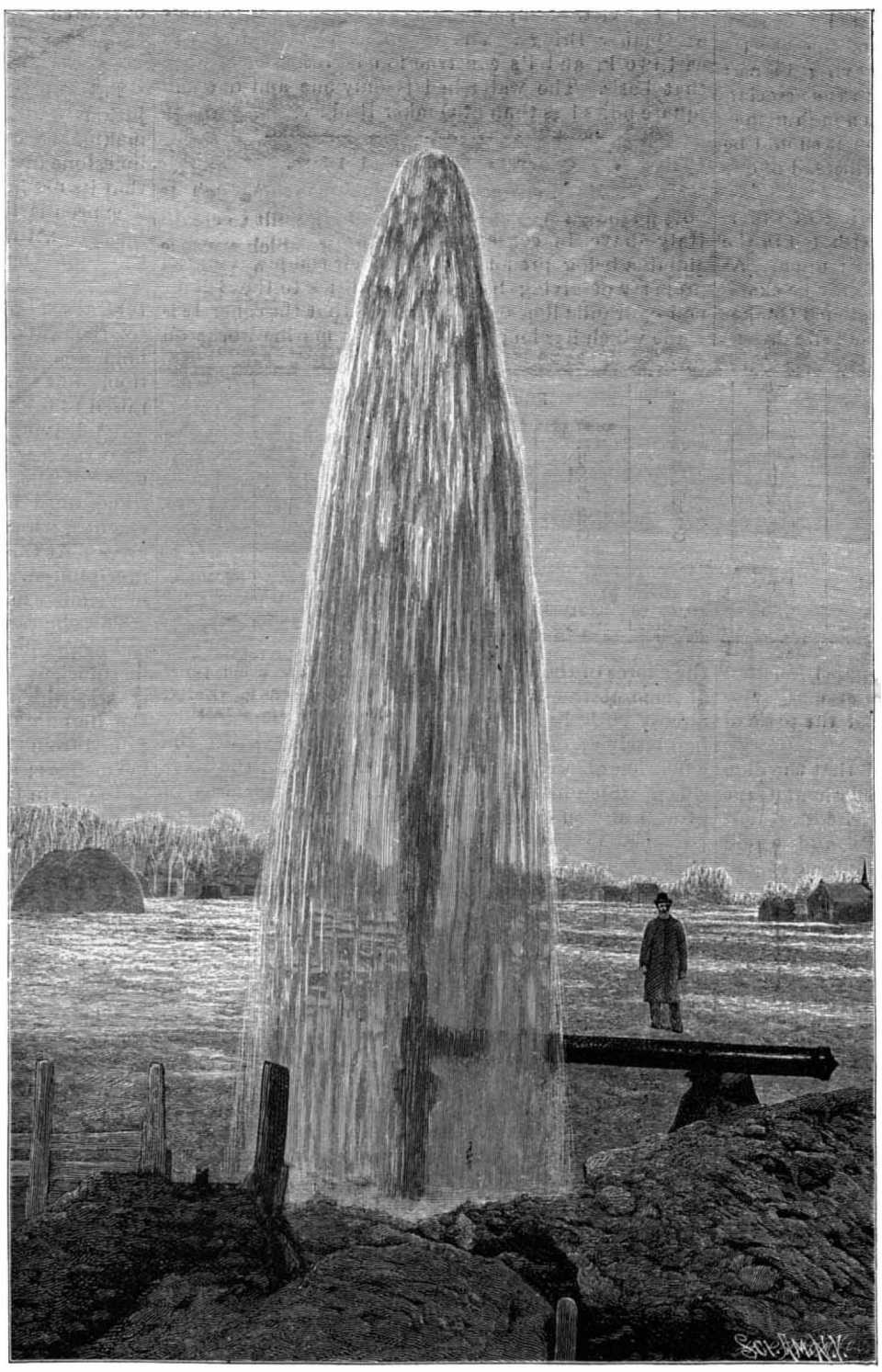
THE ARTESIAN WELL AT SPRINGFIELD, SOUTH DAKOTA.

We give an engraving herewith of this well as it appears in operation. It is 592 feet deep, 8 inches diameter. The pressure of the water is 60 pounds to the square inch. By using the proper nozzles on the pipe it throws a solid stream 8 inches diameter 12½ feet high, a 6 inch stream 26 feet high, a 4 inch stream 62 feet high, a 2 inch stream 88 feet high. It furnishes power to drive a 60 barrel flour mill, with a large surplus.

Our engraving is from a photograph by Mr. B. W. Burnett, of Tyndall, South Dakota.

A correspondent of the *Rural New-Yorker* describes another well located near Aberdeen, South Dakota. It has a depth of over 1,000 feet. The pipe is six inches and the pressure about 150 pounds to the square inch. From it the owner expects to irrigate his farm of 800 acres.

The supply of water appears permanent and bountiful, and if half the expectations of the people be realized, a new era will dawn upon Dakota. Already a number of farms, level and well located, are watered by means of artesian wells, and give excellent results. Of course all farms cannot be irrigated. A farm must be smooth and with a gentle slope, with the water at the highest point, in order to give the best results. Still, there are many such that could be made very productive with abundant water.



ARTESIAN WELL AT SPRINGFIELD, SOUTH DAKOTA.

Storage Battery Road at Dubuque, Iowa.

The Dubuque, Iowa, *Times* of a recent issue has an enthusiastic description of the new electric railway system of that city. Storage batteries are used to furnish the current and the Dubuque paper claims that, although single cars have been propelled for a short time by this system in other cities, "the Dubuque Street Railway Company is the first to equip its entire system with this latest and well nigh perfect invention for the cheap and rapid transportation of the people."

Nine cars are already in operation. A section of the floor of each car can be lifted up, disclosing the racks containing the accumulators. Each car is supplied with three incandescent lights. The electrical equipment was furnished by the Electro Dynamic Company, of Philadelphia.

The new system appears to give great satisfaction, and already representatives of other cities have visited Dubuque to inspect it. It has inspired the *Times* man to give utterance to the following eloquent description: "There is no tangle of overhead wires to spoil the view. But down the street, swiftly and silently save for the loud ringing of the warning gong, comes a beautiful car, skimming over the rails like a thing of life, yet so perfectly under the control of the "motorneer" that it can be brought to a standstill in half a car length. There is no rocky motion, no jarring. The cars run as smoothly and with apparently as little friction as a bird flies through the air."

Canadian Pacific Enterprise.

Speaking of the late fast trip of the Canadian Pacific flier across the continent, the *Financial Times* (London), says: "The Canadian Pacific Railway has been very much in evidence of late. It is at once ubiquitous and irrepressible. Its enterprise breaks out in the most unexpected places, and produces results which startle red-tape people out of their propriety. Even the Americans have been taken aback by the Canadian Pacific. They do not know what to make of it, or how to regard it. It will not fit into their preconceived ideas of the Canucks as a sleepy, short-sighted race, whose destiny is to sink gracefully into the folds of the stripes and stars when they become ripe for that distinguished honor. Whatever else may get swallowed up in the almighty union, it is not to be the Canadian Pacific Railway. That seems to be well able to take care of itself, and it swallows more of American trade than the Americans like to see going past them. Its latest feat has, like all the rest, a dash of romantic brilliance. Without any fuss or preliminary flourish it has started a new mail service, which cuts down the orthodox course of post between London and China by nearly a week. In the overland journey across America it has saved at a stroke fully two days out of six. The first through mail from the East did the 4,300 miles from Yokohama to Vancouver in less than ten days, and the 2,900 miles from Vancouver overland to Montreal in 3 days, 17 hours, making barely two weeks from Yokohama to Montreal."

Stone Walling.

Of whatever quality the stone may be of which a wall is to be built, it should consist as much of stone and as little of mortar as possible. If it be inferior in durability and power of resisting the action of the atmosphere, etc., to the mortar, besides the certain fact that the mortar will yield until it has set hard, and so far act injuriously, no ulterior good is gained; and if the stone be the more durable material, the more of it that enters into the wall, the better. Indeed, in rough walling, if the stones be pressed together until the more prominent angles on their faces come into actual contact, the interstices being occupied by mortar, it will be better than if a thick yielding mass were allowed to remain between them. Absolute contact, however, should not be permitted any more than in brickwork, lest the shrinking of the mortar in drying leave the stones to such unequal bearing as the prominent parts alone would afford. Stone being generally of a less absorbent nature than brick, it is not a matter of much importance that it be wetted before setting. Nevertheless, adhesion on the part of the mortar is more certain and more complete if the stones be worked in at least a damp state. Bond is of not less importance in stone walling than in brick laying. Instead of carefully making the joints recur one over the other in alternate courses, as with bricks and gauged stones, the joints should as carefully be made to lock, so as to give the strength of two or three courses or layers between a joint in one course and one that may occur vertically over it in another. In bonding through a wall or transversely, it is much better that many stones should reach two-thirds across, alternately from the opposite side, than that there should be a few thorough stones, or stones extending the whole thickness of the wall. Indeed, one of the many faults of stone masons is that of making a wall consist of two scales or thin sides with thorough stones now and then laid across to bind them together, the core being made of mortar and small rubble merely. This is a mode of structure that should be carefully guarded against. There is no better test of a workman's tact and judgment in rubble walling than the building of a dry wall, or a wall without mortar, affords. Walls are frequently built with mortar that without it would have fallen down under their own weight in a height of six feet, in consequence of their defective construction, thus rendering it evident that they are only held together by the tenacity of the mortar, which is very seldom an equivalent for a proper bond of stone. Masons are very apt to set thin broad stones on their narrow edges to show a good face, by which the wall is injured in two ways. It tends to the formation of a mere case on the surface of a wall, and it for the most part exposes the bed of the stone to the atmosphere, as a stone is more likely to be broad in the direction of its bed than across it.—*Builder, Decorator, and Woodworker.*

Chloralamide.

Dr. John Gordon, of Aberdeen, has resumed his study of recently introduced hypnotics, taking on this occasion chloralamide. His results are communicated to the *British Medical Journal.* After referring to the chemical and physical properties of the substance, Dr. Gordon gives the results of his experiments with it on blood pressure and respiration, its action on motor nerves and on muscle substance, after which clinical observations are mentioned, including the effect of the drug upon the urine, pulse, respiration, and digestion. In regard to its hypnotic action he says that "with the smaller doses there was no evidence of any sleep-inducing power, but when doses of 20 grains and upward were given and the subject placed in favorable surroundings for sleep, the hypnotic influence became evident. As a rule, sleep came on in about half an hour after the dose. The sleep induced was pleasant, tranquil, and easy, awakening was gradual, and without mental confusion, headache, or depression." Only in one case was excitement observed, and that is to be regarded as exceptional. In addition to the direct hypnotic action of the drug, it was frequently observed that the patient being once put in the way of sleep, there followed a series of sleepful nights. Still more frequently was it noticed that on the night succeeding the administration of the drug, sleep supervened spontaneously. That this did not depend upon deferred action of the drug is shown by the fact that the patients stated that they had no feeling of drowsiness or depression during the day. In no case was it noticed that a craving for the drug was developed, although in some cases it was given for two or three weeks almost nightly. The results were most satisfactory in senile insomnia, pulmonary diseases, and hysteria.

The Nickel in Slot Library.

The invention consists of a box, fitted with a glass front, through which the titles of the books within may be clearly seen. Each box forms a library, and is divided into as many sections as may be needed, and each section holds one book. These library boxes can be fixed in railway carriages and elsewhere. Apart from the pattern for railway carriages, where space is the first consideration, the library boxes will also be made in various shapes of artistic design to stand on the mantelpiece or the table. Any one wishing to take a volume from the library places a penny in the slot of the section containing the selected book, and, on pressing back a small lever attached to the section holding that book, the door is freed and the book can be taken out. The door of the section out of which a book has been taken will not close until the book is replaced.

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SIMPLE APPARATUS FOR GATHERING AND EXAMINING MICROSCOPIC OBJECTS.

BY GEO. M. HOPKINS.

One of the difficulties experienced by the beginner in microscopy is the finding and gathering of objects for examination. As a rule, cumbersome apparatus has been used. The conventional apparatus consists of a

Fig. 1.—GATHERING MICROSCOPIC OBJECTS.

staff to which are fitted a knife, a spoon, a hook, and a net; but a great deal can be accomplished with far less apparatus than this.

The engraving illustrates a simple device by means of which the amateur microscopist can supply himself with as much material as may be required. It consists of an ordinary tea or dessert spoon, and a wire loop of suitable size to extend around the bowl of the spoon, having the ends of the wires bent at right angles and hooked in opposite directions. To the loop is fitted a

Fig. 2.—TRANSFERRING MATERIAL TO THE BOTTLE.

conical cheese cloth bag, and to the bottom of the bag, upon the outside, is attached a strong string, which extends over the top and down to the bottom of the bag, where it is again fastened. The spoon is inserted between the bent ends of the loop and turned, and the point of the bowl is slipped through the loop.

The instrument is used in the manner shown in Fig. 1, that is to say, it is scraped along the surface of objects submerged in the water, the water passing through the cloth and the objects being retained by the conical bag. When a quantity of material has accumulated, the bag is turned inside out by pulling the string, and the pointed end of the bag is dipped a number of times in water contained in a wide-mouthed bottle. The operation is then repeated. The objects thus washed from the bag are retained in the bottle for examination.

The common method of examining small objects of this kind is to place a drop of water containing some of the objects upon a glass slide by means of a drop tube, then to apply a cover glass and remove the surplus water by the application of a piece of blotting paper. This answers very well for the smaller objects, but the larger ones must be examined in a tank like that shown in Fig. 3. This tank consists of a glass slide, A, to which are attached three glass strips, B, by means of cement (bicycle tire cement answers well for this purpose), the strips forming the bottom and ends of the tank. The front, C, of the tank is formed of a piece of a glass slip attached to the strips by means of cement. To vary the thickness of the body of water contained in the tank, when necessary, one or more glass slips are inserted behind the object.

THE ST. CLAIR TUNNEL LOCOMOTIVES—THE LARGEST LOCOMOTIVE IN THE WORLD.

The engraving shows a new design of tank locomotive built for the Grand Trunk Railway of Canada by the Baldwin Locomotive Works. It is known as the "Decapod Tank Freight" type, and has a guaranteed hauling capacity of 760 tons (2,240 lb.) up a two per cent grade. Four of these engines are built to operate the St. Clair tunnel, a description of which appeared in the SCIENTIFIC AMERICAN, August 9, 1890. At either end (in the cuttings and in the tunnel) there is about 5,000 ft. of the two per cent grade.

The general dimensions and description of this engine are as follows:

Cylinders	22 in. diameter by 28 in. stroke.
Driving wheels	50 in. diameter.
Driving wheel centers (cast iron)	44 in.
Tires (standard Otis steel)	3 in. thick.
Tires, first, second, fourth and fifth pairs, flanged, 5½ in. wide; third pair, plain, 6 in. wide.	
Tires secured by Mansell retaining rings.	
Tires, first and fifth pairs, 1 in. play between rails; second and fourth, ¾ in. play.	
Boiler of ⅝ in. steel	74 in. diameter.
Rivets	1 in. diameter, 2¼ and 3⅛ in. centers.
Laps—all longitudinal seams have double-riveted butt joints, with double covering strips.	
Steam pressure	160 lb. per square in.
Tubes, 281, iron	2¼ in. diameter, 13 ft. 6 in. long.
Firebox	132½ in. long by 42⅛ in. wide.
Water spaces	3 in. wide at sides, 4 in. at back.
Firebrick arch supported by top bolts.	
Side screw stays, ⅞ in. diameter; crown screw stays, 1 in. diameter, riveted over at top and bottom.	
Grates	Water tubes with drop bars.
Fuel	Anthracite coal.
Crossheads of cast steel, with phosphor bronze bearings.	
Steam chest valves	Balanced.
Cylinder lubricators	Seibert sight feed.
Injectors	Two Friedman No. 10 W. F.
Brakes—Westinghouse American, operated by air, on fronts of all wheels, with Ross-Mechan shoes.	
Tank capacity, 1,800 gallons (277 cubic in.) of water and 3 tons of coal.	
Wheel base total	18 ft. 5 in.
Gauge of track	4 ft. 8½ in.
Weight on drivers in working order	195,000 lb.
Cooke steam bell ringer.	

The weight on drivers is greater than that of any other locomotive which has come to our knowledge. It is believed to be the largest locomotive in the world, and with a coefficient of friction on the rail of 600 lb. per ton would give a hauling force on the drawbar of 58,500 lb. The resistance of 760 tons on a two per cent grade is about 39,400 lb. Add to this the resistance of

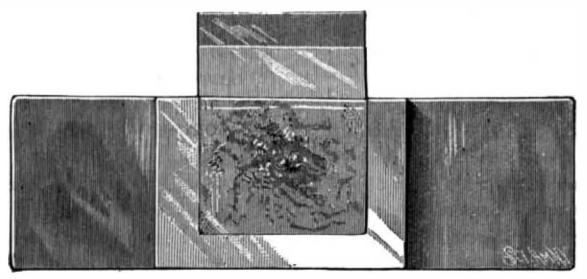


Fig. 3.—TANK FOR MICROSCOPIC OBJECTS.

the engine itself—about 5,000 lb.—and the total resistance to overcome is about 44,400 lb. This is with the liberal allowance of 7 lb. per ton of load for friction. Hence it is seen that this engine has a considerable margin in which to work with a clean rail. The rails used will weigh 100 lb. per yard.

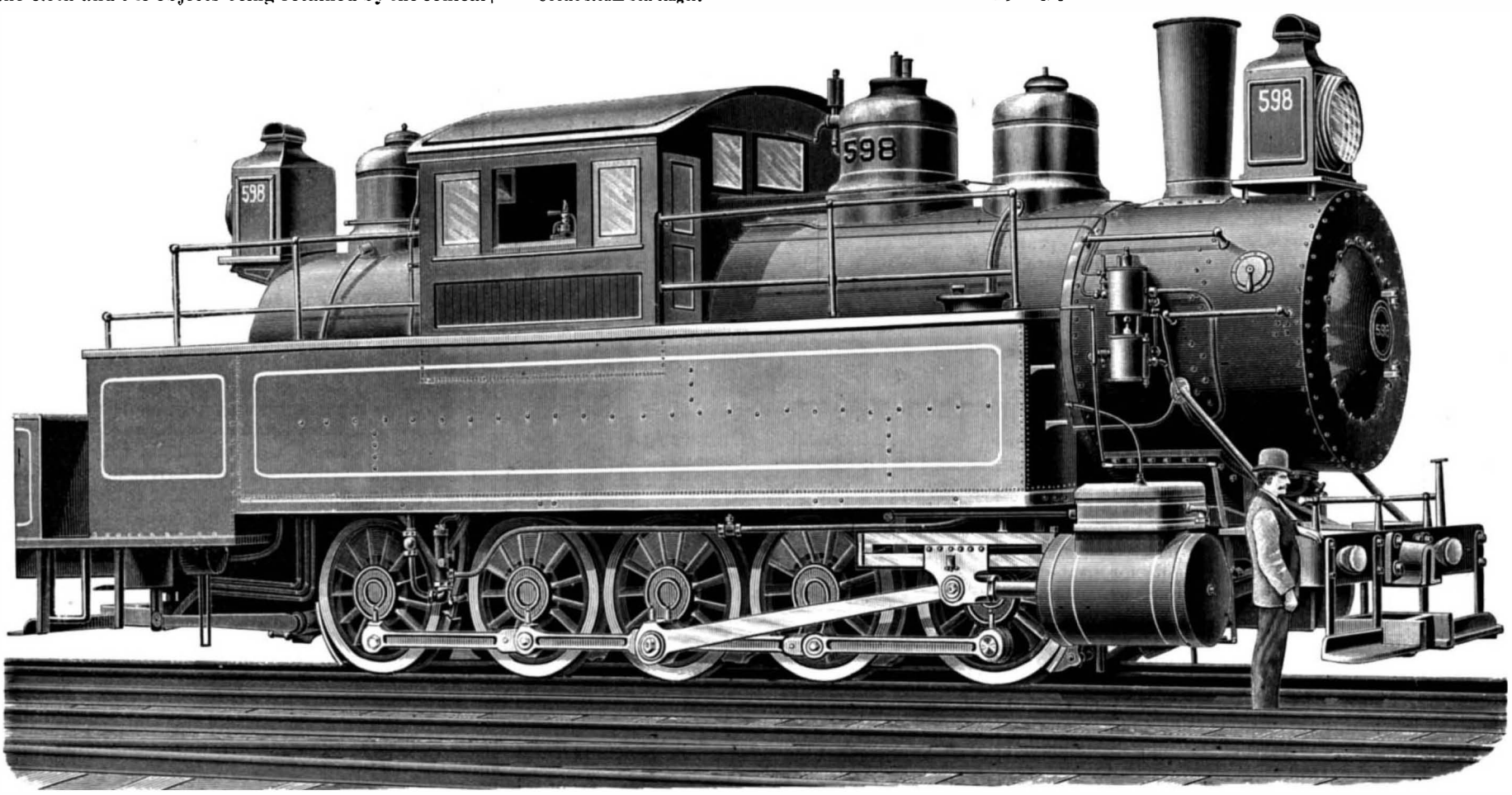
Builder.	Road.	Date.	Type.	Cylinders.	Weight on drivers, lb.
Central Pacific	C. P.	1884	El Gobernador.	21×26	121,600
Baldwin	Brazil	1885	Decapod.	22×26	128,000
Beyer, Peacock & Co.	Mersey Tunnel.	1886	10 wheel tank.	21×26	115,556
Baldwin	Phila. & Reading.	1888	Consolidation	22×28	138,000
"	B. & O.	1889	"	20×26	112,900
"	North'n Pacific.	1889	"	22×28	135,000
"	St. Clair Tunnel.	1891	10 wheel tank.	22×28	195,000

This is a particularly handsome engine and represents very forcibly the lines which American builders are following to reach the most economical type of heavy freight engine.

Fig. 4.—CROSS SECTION OF TANK.

The boiler fronts are of pressed steel, and of an excellent design, easily repaired and kept tight. The guides are short and heavy, with large wearing surfaces at the crosshead, an excellent example of the Laird type. The side rods have solid ends and all of the latest improvements. The boiler is one of the largest, if not the largest, that has ever been constructed for a locomotive; it is 74 in. diameter and is made of ⅝ in. steel plates.

The table above gives the weights and other particulars of the largest engines built in the last decade. We are indebted to the *Railroad Gazette* for the foregoing particulars.



THE ST. CLAIR TUNNEL LOCOMOTIVES—THE LARGEST LOCOMOTIVE IN THE WORLD.

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The Prophylaxis and Treatment of Diphtheria.

At the recent meeting of the American Medical Association, Washington, D. C., Dr. J. Lewis Smith, of New York, read a paper on this subject. The room should be disinfected by adding to one quart of simmering water one to two fluid ounces of the following mixture :

℞. Oil of eucalyptus..... 3j.
Carbolic acid..... 3j.
Turpentine, q. s. ad..... 3vj. to 3viij.

Everything and every person not absolutely necessary for the comfort and management of the patient should be excluded from the sick room. Physicians undoubtedly conveyed the disease. They should always examine the fauces by standing behind or at the side of the patient, so that no ejected mucus may come upon them. After each visit they should wash thoroughly, in a sublimate solution, hands, face, and beard. Walking cases without fever, anorexia, or malaise diffused the disease. Daily inspection of the fauces of school children had been proposed. Convalescents should not mingle with healthy children for four weeks. He admitted the full claim of the Klebs-Loeffler bacillus to be the cause of the disease. It was a surface microbe—never penetrating the interior of the body, but attacking only mucous surfaces or cutaneous abrasions. It produces a ptomaine containing carbon, hydrogen, azote, sulphur, and oxygen, which, by absorption through both blood and lymph channels, causes the nephritis-granulo fatty degeneration of heart muscle and paralysis.

The treatment should embrace hygiene, diet, and alcohol. Rectal alimentation could be followed for a time. Failure of appetite rendered the outcome doubtful. Diet could embrace milk with sarco-peptones, beef tea, or meat juice, and the various predigested compounds. Large and frequent doses of alcohol were positively necessary. It is quickly eliminated, and often will save life unless blood-poisoning has actually set in. In the proportion of one to five it has been shown to have a destructive action on the growth of the bacillus.

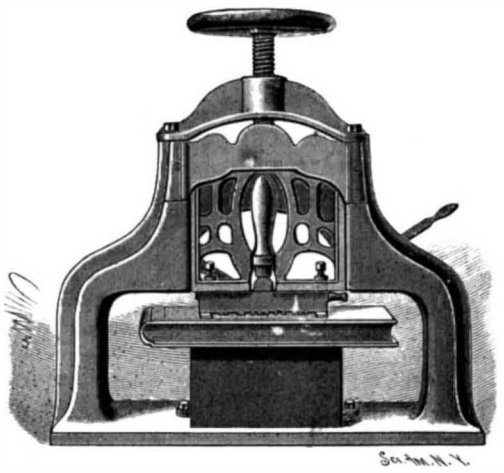
Locally we should remember that normal epithelium was a barrier to the germ's entrance, and hence our remedies should be such as not to destroy the epithelial covering. Denuded or diseased surfaces were favorable starting points for the disease. Corrosive sublimate, 1 to 8,000; carbolic acid, 1 to 50; salicylic acid, 1 to 80; had proved of service in arresting the germ growth. Potassic chlorate was useless in this direction, and he had come to discard its internal employment entirely. It had undoubtedly caused nephritis in many cases. The corrosive sublimate could be given by nasal injection, gargling, and internally. Where the false membrane was very thick and tenacious, equal parts of tincture of iron and glycerine should be given three or four times a day. Loeffler himself uses a mixture of carbolic acid, alcohol, and distilled water for the mouth. Our local remedies should be penetrating. Therefore, glycerine and water, never sirups and mucilages, should be our vehicles for all local applications. The officinal solution of iron chloride might be diluted three or four times for this purpose. While it undoubtedly contracted the vessels, it was often painful. It congeals the muco-pus of the fauces. Carbolic acid, Monsel's solution, and glycerine could be advantageously used in this way. For nasal disinfection a saturated solution of boric acid was preferable.

For internal treatment, iron assisted the anæmic condition. Vegetable tonics, including quinine, were probably useless, as were also quinine insufflations in the oral cavity. The main reliance was to be placed on the bichloride. He was in the habit of giving a two-year-old child $\frac{1}{72}$ grain every two hours; four years, $\frac{1}{40}$ grain; six years, $\frac{1}{36}$ grain; ten years, $\frac{1}{24}$ grain. His solution was made by dissolving the sublimate in alcohol and adding elixir of bismuth and pepsin. Sublimate solution, two grains to the pint, could be used for the nose. The mercurial should be continued at least one week, unless diarrhœa supervened, but not longer. Calomel had been suggested. Many gave an initial dose, and some continued it through the entire disease. It undoubtedly increased the anæmia. Of late it had been given in the New York Foundling Asylum by sublimation, from ten to forty grains being used, under a tent made over the patient's bed. The indication for its use was the supervention of hoarseness. The attendants had been salivated in several instances, but the patients were apparently not injured. It seemed to lessen the necessity for intubation. The process might be repeated in three or four hours. The percentage of recoveries from intubation where necessary was better in the calomel cases than in others. For the nephritis he gave iron, and for the paralysis tonics, strychnine, and electricity.

Dr. A. Seibert, of New York, remarked that we must see way down to the epiglottis in order to have our examination amount to anything. Children should not be allowed to kiss each other when there was any sore throat about, and very young children should not be allowed to creep around on the floor. They scraped up the dust with their fingers, which they would afterward put in their mouths. Thus the germs which settled on the floor were conveyed to the sensitive membranes. The experiments of Gebhardt, of Bonn, had shown that false membrane could be dipped in a sublimate solution, and then, after drying and teasing, cause a bacillus development in a culture medium. It was, therefore, especially under the conditions of diphtheria, slow in germicidal action, but thorough if once brought into perfect contact with the affected areas. A five per cent solution of acetic acid had been shown to be quickly penetrating.

A BOOK FINISHER'S LETTERING MACHINE.

A machine to facilitate the placing of a design or title upon a book cover is shown in the accompanying illustration, and forms the subject of a patent which has been issued to Mr. George H. Reynolds, of No. 352

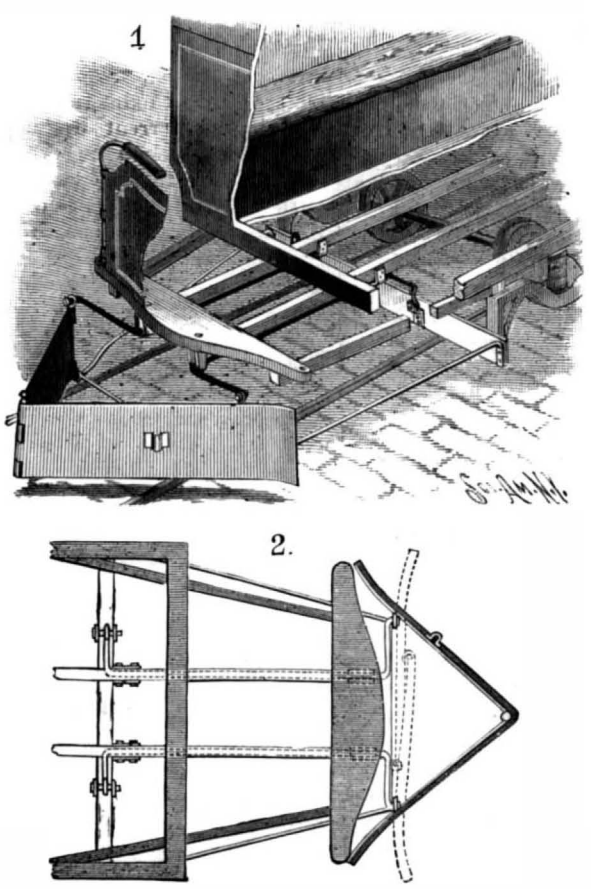


REYNOLDS' BOOK FINISHER'S MACHINE.

East Eighty-sixth Street, New York City. The standard has a vertical housing frame having opposite parallel guide grooves for the reception and support of a sliding head block, in two side limbs of which the pallet is adjustably held, the handle of the pallet extending upwardly in a central opening of the block. The head block is adjustably connected to the housing frame by a coarse-threaded screw, by the manipulation of a hand wheel on the upper end of which the block is vertically reciprocated in the guide grooves. The pallet or hand tool is of ordinary form, such as is used by bookbinders in finishing the backs of bound books to be lettered or ornamented by type impressions. After the desired name or type design is assembled and secured in the heated pallet frame, the pallet is secured in position between the limbs of the sliding block, when the required impression is given by turning the hand wheel. A guide is also provided, for regulating the placing of the book in proper position in the machine, and, to hold the book down in place, when the cover may be warped, or for convenience at any time, a simply operated hand lever is provided at the rear.

THE HITCHCOCK LIFE GUARD FOR ELECTRIC CARS.

The illustrations show a form of life guard or fender designed for use on electric street cars. The body of these cars is subject to violent oscillations, so that a



THE HITCHCOCK LIFE GUARD FOR ELECTRIC CARS.

fender attached to the end of the car vibrates up and down to such an extent as to be of little use. In the structure we describe, the weight of the fender is carried by the motor guard or some other attachment of the truck. A pair of bars run longitudinally and each bar has two crank arms at each end. The straight portions of the bars are attached to the car body, being journaled thereto. The rear cranks have their outer ends attached to the motor guard or to some part that maintains a fixed level. The front cranks carry the fender by attachment to their outer ends. Thus arranged, although the car body may vibrate through a distance of seven inches or more, the fender never changes its level. At the same time its weight is carried without exercising any destructive leverage upon the truck. The construction is shown in perspective in Fig. 1, and in plan in Fig. 2.

Another feature of the fender is that it can be folded back so as to occupy no storage room in the car sheds. The center angle is a hinge joint. By withdrawing the hinge pin the wings fold inward, as shown in dotted lines in Fig. 2, and the car requires no additional room.

This fender is the subject of letters patent granted to Arthur B. Hitchcock and Charles S. Gooding, of Brookline, Mass., to whom inquiries for further particulars may be addressed.

American Armor Plates for American War Ships.

A new naval ordnance proving ground, which has been established at Indian Head, on the Potomac, will soon be the scene of a test of ship armor worthy to be ranked with the great trial of last September at Annapolis. In some respects it may be considered still more important, according to particulars given in an Associated Press account, since it is intended to definitely settle what kind of plates shall be put on our new war vessels.

The magnitude of the coming trial is further shown by the number of plates that will now be put in competition, each of the standard dimensions, 8 feet long, 6 feet wide, and 10½ inches thick. All these are under construction by Carnegie, Phipps & Co., of Pittsburg. They will represent steel, steel with nickel alloy, steel treated by the Harvey carbonizing process, and nickel-steel treated by this process. Those that are to be hardened on the surface by the Harvey system will have it applied to them, it is said, at the Washington ordnance yard.

It will be seen that the forthcoming trial is to be of the same general character as the one which took place a few weeks ago on the Annapolis proving ground, but with the important difference that plates three and a half times as thick will now be used, and will be fired at by 6 inch and 8 inch guns. A further interest will be lent to the trial by the use of some American-made projectiles, as furnished by the Carpenter Steel Company, which is manufacturing them for the Navy Bureau of Ordnance on the Firminy system. As a competition in which American-made armor, guns, and shells are employed, it will have an unprecedented importance for this country at least.

An Improvement which Failed to Improve.

Mr. Metcalf, in a discussion at the late meeting of the American Society of Civil Engineers, concerning water supply, said: "We have had at times a great deal of trouble in getting a water supply for our establishment because of the floods in the Allegheny River, and a couple of years ago I thought I would make a great improvement. I had the Philadelphia Company send their dredge up and dredge a place some 10 or 15 ft. deep in the bed, and near the mouth of the Allegheny River. I then had a heavy timber crib built in the space thus dredged, and sunk our suction pipes into this crib. We got a beautifully clear water, and thought we had done a very great thing, but in a few days our whole concern was up in arms. A great many complaints were made, and they told me they could not get the boilers clean. The man in charge of the boilers said if he had to use that water he would give up the job, because he knew the result would be an explosion. Of course, I thought they were simply pumping out a little loose sand, but I had Professor Langley take up the matter and analyze the water to see if there was any real cause for trouble. The Allegheny River water is a very soft, delicious water, and we found that we had in that short distance of 12 or 15 feet struck a sub-river of lime water some 12 feet below the Allegheny, which contained thirteen times as much impurity as the muddiest river water we could get from a dirty flood stage in the river. So we were obliged to destroy the crib at considerable expense."—*The Railway Review.*

DOVER, N. H., is one of the few towns in New England, or, indeed, in the country, that operates its electric street railway system without the aid of a steam engine. The Salmon Falls River, which flows near the town, turns a 500 horse power water wheel, which supplies power for the dynamos that operate the street line, the electric lights in the place, and electricity for several neighboring towns as well. There seems to be no difficulty in obtaining a sufficient amount of power at all seasons of the year.

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EDISON'S KINETOGRAPH AND COSMICAL TELEPHONE.

Recently the daily papers have been filled with reports of interviews with Edison, from which the reading public would obtain the idea that Edison had lately invented something of paramount importance, whereas these inventions, as curious and wonderful as they appear, are, in reality, scarcely more than the pastime of the hour with Mr. Edison.

The "kinetograph" is a machine consisting of a clever combination of a photographic camera and the phonograph, by which the words and other sounds of a speech or play are recorded simultaneously with the photographic impressions of all of the movements of the speaker or actor. The photograph impressions are taken at the rate of forty-six per second, and the phonograph has its capacity increased so that it will make a continuous record for thirty minutes without any shifting of the cylinders. The celluloid film upon which the photographic impressions are taken is perforated along one edge with a series of holes arranged at regular intervals with as much precision as can be secured by means of the finest perforating mechanism. This feature is of vital importance, for the holes must move the film with such regularity as to make each separate impression when reproduced coincide exactly with the words or sounds recorded in the phonographic cylinder simultaneously with the position and expression of the speaker, actor, or singer at the time the sounds were uttered. Exact synchronism between the sound-recording mechanism and the shutter-operating and film-moving devices of the camera necessitates exceedingly accurate mechanism both in the recorder and in the reproducer. The phonograph and camera mechanism in both cases is driven by the same motor, and controlled by the same regulating mechanism.

The greatest difficulty experienced in taking the photographic impressions and reproducing them was in the stopping and starting of the film. It was found that the stopping and starting of even so light a thing as the film forty-six times in a second required about two-thirds of the time, the remainder being utilized for the exposure of the plate. To secure enough light for the production of a good image in so short a space of time, a special camera lens of large aperture had to be constructed, at a cost of $600. The apparatus has already been carried to such perfection that the motion of the speaker's lips coincides so exactly with the words reproduced by the phonographic cylinder that the words actually seem to proceed from the picture, and all the movements of the speaker or actor are reproduced by the succession of the different images with such rapidity as to make the picture appear absolutely continuous, instead of intermittent, as it really is.

The reproducing apparatus is practically a reversal of the camera and phonograph; that is to say, instead of the photographic camera, a superior form of projecting lantern is employed, which is provided with a strong light and mechanism for moving forward the strip with an intermittent motion corresponding exactly to the motion of the negative strip in the camera, and, like it, acting in perfect synchronism with the phonograph. The lantern is also furnished with a light interrupter, which eclipses the light during the brief period required for shifting the film forward to a new position to show the succeeding picture. The phonograph with its resonating horn is able to reproduce the sounds so that they may be easily heard in any part of an ordinary hall without the necessity of applying the ear to the instrument, as in the case of the commercial machines, and the successive pictures necessary to produce the effect of motion upon the screen follow each other with such rapidity, and with so little change in the successive positions, as to give the picture all the appearance of life.

Mr. Edison is at work preparing apparatus on a large scale, which will be finished in time for exhibition at the Chicago Exposition. This apparatus does not seem to be adapted for universal use, although a favored few may be able to enjoy it. It will give to public speakers, actors, and opera singers the gift sighed for by the poet, who said:

"Oh! wad some pow'r the giftie gie us,
To see oursels as others see us!"

We think if some of our public speakers would patronize a machine of this kind, they would soon change their style of oratory. May we not expect the early adoption of this instument in institutions where elocution forms a branch of education?

While talking with Mr. Edison in regard to this novel invention, the subject of his cosmical telephone was brought up. He states that he is really carrying the project into execution in the form of a practical experiment at his iron mine in Ogden, N. J. With this telephone he expects to hear the sounds of some of the terrific operations going on in the sun. Some years ago, when the long distance telephone with a metallic circuit was being experimented with, Mr. Edison had control of a long line, and he says that he frequently heard very strange sounds in the telephone, which could have proceeded from no earthly origin. As sun spots were frequent at that time, he at once attributed these effects to solar eruptions, and afterward, when experimenting at his iron mine with the magnetic needle, he found frequent, sudden, and very appreciable disturbances of the needle. These he attributed to the variable magnetic action of the sun.

Fig. 2.—PLAN OF MINE.

Fig. 3.—POSITION OF COSMICAL TELEPHONE WITH REFERENCE TO THE EARTH.

He then conceived the idea of surrounding the mine with a number of convolutions of wire which terminate in a telephone receiver and in suitable recording apparatus. The mine consists of an almost solid body of magnetic iron a mile long, four hundred feet wide, extending into the earth to an unknown depth. This immense body of iron forms the magnet of the telephone, and fifteen convolutions of wire mounted on telegraph poles surrounding the outcrop of this iron form the conductor of the telephone, and the terminals of this great coil extend to an observatory erected at one end of the mine. Mr. Edison is looking for some important revelations when this work is finished. When questioned as to the feasibility of seeing by telegraph, and his experiments in that direction, he said he is doing absolutely nothing toward solving that problem. He considered it hardly worthy of attention, but he stated that photographic pictures could be sent telegraphically as readily as hand writing or diagrams, that he had accomplished this by means of an ordinary photographic negative used in the electro-chemical telegraph, and also by means of a common photograph used in the electric motorgraph.

Forging Metals by Electricity.

A committee from the Franklin Institute, Philadelphia, Pa., and a number of newspaper men lately witnessed a very interesting exhibition of forging by electricity at the factory of the Electrical Forging Co., 163 to 169 Oliver Street, Boston, Mass., which is thus described by the *Journal of Commerce* of that city. The plant of the company consists of a 60 horse power electric motor, fed from the Edison circuit, driving an alternating current generator, and a special converter in which the electro-motive force can be reduced to a very low voltage and increasing the current up to 12,000 amperes. To this converter is attached the heating apparatus, which at present consists simply of a number of bronze clamps with electrodes of peculiar design and construction, and which holds the piece to be heated. In addition there are a large number of presses, rolling machines, and like apparatus for the production of all the different articles that can be rolled or pressed from a bar of heated metal.

Interest is mostly felt, however, in the machinery that heats the metal. This is capable of giving to the piece to be heated current according to the desire of the operator, and all is within his control. A bar of wrought iron inserted in the jaws of the machine was in a few seconds at a white heat, and finally melted, dropping to the floor a liquid mass. Another piece of steel was heated, one end fastened in a vise and twisted in close spirals throughout its entire length at one heat. Other pieces wound about a mandrel formed a spiral spring at a single heat.

A three-eighths inch rod of steel was heated in a few seconds, beaten into a knife blade, ground, and inserted in a handle within a short time. A square bar of three-fourths inch iron was heated evenly throughout its length and worked into different shapes on the anvil and straightened again at a single heat. Many other interesting tests were made, all showing the rapidity with which the iron and steel can be heated by electricity and heated evenly within any limits desired.

The methods used being comparatively in the earliest stage of development, were necessarily crude, so that the exhibition, it seems to us, was of value more particularly because of the possibilities it opened up. Forging of every description may be done, from that ordinarily given to the blacksmith to work now done at the expenditure of considerable labor and time in specially prepared machines. Its capacity is limited only by the number of dies that can be made for the different articles it is intended to produce. The superiority of the method lies in the evenness with which the whole mass is heated. The blacksmith now heats the outside of his metal to a white heat, while the inside is comparatively cool. Under these conditions the outside rapidly gives off its heat and the work must again be placed in the forge to be reheated for further working. Then the metal is unevenly heated throughout, and when rolled or pressed into various shapes is entirely unreliable because of the unequal internal strains to which it is subjected by the unequal contraction of the article in cooling. In the electric method the passage of slow alternating currents heats the interior of the iron first. This even temperature is particularly valuable in the tempering of fine tools, and is absolutely necessary. It then becomes a matter of certainty instead of dependence upon the skill and judgment of a single man, probably, in a whole factory. The heating of the metal is so instantaneous that it is only in the path of the current, and the projecting ends are barely warm.

It looked little short of marvelous to see a workman hammering a bar of iron a foot long held in his bare hands, while six inches of the other end was red hot. This merely indicates how readily any desired portion can be heated without affecting the rest, simply because it has not time to conduct the heat, and also showing how free the process is from all those disagreeable things that are inseparable from the present blacksmith's forge or rolling mills. The freedom of the metal from all gases is another advantage, as it can be readily understood that when a piece is heated by a current of electricity no gases are developed, and the metal, whether it be iron, steel, brass, or composition, after having been heated by this process, is without scale, which is not possible under any other method.

The question may suggest itself as to the difference between this and the method of heating for electric welding. They are essentially different. In the well known welding process the two pieces are brought end to end like the opposite poles of an arc lamp, the imperfect contact of the two pieces concentrating the current at the point of greatest resistance, and heating that point at once to the greatest extent. As the ends are pressed together, new paths for the electricity are found until the whole or both ends are heated and forced together until welded. In the method for forging, however, the contact is as perfect as possible and heats the metal by the passage of the electricity through the metal to be heated. The process is the invention of George D. Burton, of Boston. The gentlemen from the Franklin Institute to investigate the matter were Prof. Carl Hering and Prof. Herman Hering, of the Manual Training School, Philadelphia; Prof. Pike, of the University of Pennsylvania; Mr. Billbury and Prof. Spangler.

Another Huge Blast.

According to our contemporary *Stone*, a journal in the interests of workers, users, and producers of stone, marble, and granite, published at Indianapolis, Ind., an explosion of gigantic proportions is to take place at the South Bethlehem, N. Y., stone quarry about the middle of June. The big blast of two years ago is to be not only repeated, but doubled in volume and extent. At least 50,000 tons of rock will be displaced. Mr. Callanan, the owner of the quarry, has been preparing this event since last winter, drilling going on all along the mountain face. The explosion will take place in the presence of a company of distinguished engineers, who, with a number of other invited guests, will be brought from New York and Albany by special train on the day of the blast. The explosion is expected to be unprecedented in the history of mining and blasting in this country, and will be looked forward to with interest in many quarters.

SEA water is heavier than fresh water because of the salt dissolved in it.

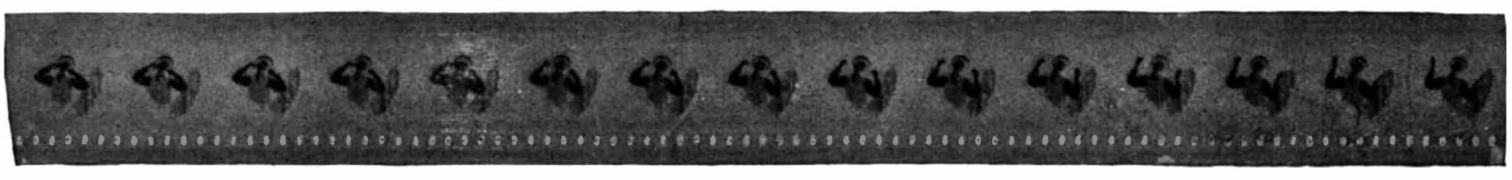

Fig. 1.—PHOTO-ENGRAVING OF A PORTION OF THE STRIP NEGATIVE OF THE KINETOGRAPH (ACTUAL SIZE).

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RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER FEEDER.—John E. Winder, Kansas City, Mo. This feeder is combined with a tank arranged above the water level of the boiler, a supply pipe entering and discharging into the tank while a nozzle within the tank opens into the supply pipe, a steam pipe connecting the nozzle with the steam compartment of the boiler. The device is designed to automatically keep the water in the boiler at a height previously determined upon, to heat the water before feeding, and to precipitate impurities before the water enters the boiler. In the feed pipe is arranged a column adapted to be filled with a suitable compound, fed gradually through a lazy cock to the tank to lubricate the several parts, and also cause the dissolution of scale or incrustation, and prevent its formation in the boiler. The device is entirely automatic in operation, and is simple and durable in construction.

AIR BRAKE VALVE.—Lewis S. Riggs, Selma, Ala. This is an automatic cut-in valve for use with compressed air pipes under cars for applying and releasing the brakes, and the invention covers a novel construction and arrangement of automatic valves in connection with the couplings and blind couplings, whereby all failures to open the air valves after the couplings are made are avoided. After the act of coupling the pipes is effected, the valves automatically open air communication through them, so that by no means can the pipes be left in an obstructed or inoperative condition.

Railway Appliances.

CAR COUPLING. — Thomas Dee, Concord, N. H. This coupling is made with two drawbars provided with lateral hooks and pivoted to the car to swing outward or away from each other only, one of the bars being longer than the other and having an enlarged head, together with other novel features. The coupling is designed to be effected automatically, but also to uncouple automatically should the car be derailed, thus causing the air brakes to set themselves and stop the car, and also prevent the derailed car from dragging the remainder of the train with it.

Mechanical Appliances.

BENCH PLANE. — Saverio Tuoti, New York City. Combined with the plane stock and cutter is a longitudinal screw in the stock, a nut on the screw engaging the cutter for adjusting it endwise, while a transversely ranging screw with a nut engages the cutter for adjusting it laterally. The construction is such that the plane iron sets at quite a sharp angle with the working face of the plane, so that it will cut very easily, while the means for adjusting the plane iron endwise and laterally are simple and efficient, while a face section is adjustable to regulate the size of the shaving throat, insuring the true and smooth working of the plane on any quality or grade of hard or soft lumber.

BARK MILL.—Albert F. Jones, Salem, Mass. In this mill an annular base with a hub in the center is rigidly secured to the hopper, radial wings in oblique planes connecting the hub and base, a bearing sleeve in which is journaled a shaft being arranged in the hub, while a horizontal revolving knife-carrying disk is mounted on the lower end of the shaft and adapted to revolve beneath the oblique radial wings. The construction of the machine is such that its various parts can be readily adjusted, removed and replaced, while in operation it is designed to reduce the bark more rapidly and much finer than the machines now in use.

Agricultural.

HAY LOADER. — Adolph and Albert Lasack, Oxford Junction, Iowa. This invention covers an improvement on a machine formerly patented by Adolph Lasack, there being but one crank shaft provided for the improved implement, while the feed arms are made to practically correspond in shape to the shape of the bed over which they travel, thus increasing their working area, the arms being in spring-controlled sections, one of the sections of each arm serving as a rake head. The implement is so lightened and simplified by the improved construction that it may be readily worked by an inexperienced operator.

Miscellaneous.

SUSPENDERS. — Andrew J. Bobbs, Marion, Ind. A narrow back piece is, according to this invention, adapted to be worn between the shoulders and along the spine, the back piece being stiffened by a stay of steel or whalebone, while supporting and bracing straps connected with the back piece cross each other diagonally thereon, and a cross strap is arranged at right angles to the back piece, the fastening and supporting devices being secured to the ends of the cross and supporting straps.

ADDING MACHINE.—James Richardson, North Tarrytown, N. Y., and Frank E. Heath, New York City. Combined with keys representing the figures from 0 to 9 are registering and verifying wheels, with a mechanism for imparting motion to them according to the number carried by each key lever, with a novel positive carrying mechanism for causing any wheel of the series to carry one to the next wheel in order. There are also positive stops for preventing the wheels from passing beyond the prescribed limit, and a let-off device for releasing the feeding ratchets, with a spring for returning the summation wheel turning mechanism to the starting point.

VOTING BOOTH. — Peter Zuckriegel, Tell City, Ind. This is a knockdown booth, adapted to form one of a series of booths or to be used singly, and is especially designed to facilitate voting under what is known as the "Australian system," affording secrecy for the voter, while the whole construction may be knocked down and folded up in small compass for transportation or storage. It is made with a backboard to which is hinged a series of partition boards capable of folding on each other and on the backboard, a clamping rod supporting curtains and connecting and binding the partitions. A triple booth of this kind, with half partitions or panels between each compartment, weighs only 106 pounds, affords complete privacy for the voter, and may be set up and adjusted by the most inexperienced.

TYPEWRITING MACHINE. — Michael Hearn, Hampstead, England. Combined with a carriage having a rack and a pivoted and spring-pressed lever with a pawl engaging the rack, are pivoted and counterbalanced type levers arranged in a circle, with operating key levers pivoted in the rear of the type levers, with semicircular levers pivoted near their ends and adapted to be engaged by the key levers when they are depressed, there being connections between the semicircular levers and the pawl-carrying lever. The machine is designed to be very simple and effective. A further patent has also been granted the same inventor for an improvement in typewriting machines in which weighted or balanced type levers are operated by finger keys, the type levers having a counterpoise at one end and a bevel-headed screw fitted to them.

OIL WELL BAILER VALVE. — Andrew W. Knittel, Evans City, Pa. Combined with an outer tube provided with a valve supported by a forked shank secured to the inner wall of the tube and projecting below it, is a sliding sleeve fitted to the tube and having a valve seat furnished with a forked barbed rod or spear, to limit the movement of the sleeve and loosen the sand in the tube. The bailers are used for the removal of salt water and oil, and the valve is designed to be unaffected by the presence of sand.

MAST HOOP.—Charles S. Mott, Patchogue, N. Y. This hoop is made with two abutting ends, one having a dovetail tongue and the other a dovetail recess to receive the tongue, a sliding sleeve being adapted to cover the connected ends of the hoop, with means for locking the sleeve over the joint, the device thus forming a sectional hoop capable of being readily sprung around a mast and conveniently disengaged therefrom.

BUCKLE. — Charles G. Blue, Pleasant Hill, Mo. This is a buckle for harness and other straps which have a sliding tongue, the buckle being so made that the tongue can be easily introduced within the frame and have a free movement thereon, while the strap end can be readily introduced and will be securely held in the buckle. There is no permanent attachment between the tongue and frame in this buckle, and owing to the open connection of the parts there is but little chance for fouling by dirt or other foreign matter.

SHOE FOR DEFORMED FEET.—Legrand D. Harding, Coltax, Washington. This shoe has the usual outer and insoles, and a strengthening plate is held to the soles and hinged near the ball, in connection with straps and supports secured to the sole and adapted to fasten over the foot, a support being secured to the strengthening plate on one side of the shoe and shaped to stand off from the foot. The shoe is designed to adapt itself to the movements of the foot, while maintaining pressure as required on special portions.

SPRING HINGE.—Herman A. J. Rieckert, New York City. This is an improvement on a former patented invention of the same inventor, by which the hinge is made more simple and durable in construction, being provided with a tube or casing fitted into a suitable recess in the door, and held in place by side and bottom plates screwed or otherwise fastened to the door. A spring held in the tube presses on a double-faced cam, having lugs fitting in suitable guideways, so that the door can swing in either direction, and friction is reduced to a minimum.

KNOCKDOWN FURNITURE.—Herman A. J. Rieckert, New York City. Combined with a frame provided with posts, each made in two parts, and hinges connecting the two parts of each post together lengthwise, are horizontal bars connecting the adjacent parts of two opposite posts with each other, shelves fitted between the posts and resting on the bars, and a top cover or shelf fitted on dowels of the posts. The construction is especially designed to facilitate the forming of show cases, wardrobes, tables, counters, etc., which may be quickly knocked down and folded for storage or transportation, and easily set up.

FOLDING BOX. — John Howenstine, Fort Wayne, Ind. This box is preferably made of thin wooden sheets, double pieces with their grain crossed being used for the sides, lid and bottom, the material being re-enforced by wire rods and staples, the end walls being secured to the sides and bottom by end battens, while turn-buckle latches are located on depending battens of the lid and adapted to interlock with cross pins in the end walls. The box is designed to be a strong, light, and cheap receptacle, adapted to serve for egg cases, fruit crates, etc., and to be readily set up and knocked down.

SUBSOIL PIPE.—Martin Rehm, Long Island City, N. Y. This invention provides means whereby the spigot end of a pipe section may be positively and securely locked when inserted in the hub of an opposed pipe section, by turning one section a slight distance either to the right or the left. The sections are also so made that when coupled a packing will not be needed at the joints, and their inner cylindrical faces are flush at the abutting surfaces when the sections are locked together.

LINING FOR BUTTER TUBS. — Joseph Mersman, Ottawa, Ohio. This is a lining of paper or other thin flexible material, folded outwardly over the top edge of the tub and inwardly at its lower end, where it is folded to form a flange, over which a circular false bottom of paper is placed, making a thin non-odorous removable lining, which is inexpensive and adapted to remain in upright position in the tub.

VEHICLE RUNNING GEAR.—George L. Banks, Fredonia, Kansas. This invention provides a mechanism between the body and springs, designed to prevent the latter from receiving a sudden strain, thereby adding to their durability. The improved running gear is especially adapted for use with buggies, the construction being such that the springs need not be attached to the body, the spring having an independent end movement and at the same time keeping the body level sidewise.

CARRIAGE TOP ADJUSTER. — William W. Swan, Andover, South Dakota. Two arms are each rigidly, adjustably, and detachably secured to a lower brace section, and project forwardly beyond the bows, to form a simple, inexpensive, and convenient device for the manipulation of the jointed frame supports of the vehicle cover, whereby the frame may be easily raised or lowered by one seated in the vehicle, these arms also preventing the flapping of the curtains when the top is lowered.

GATE.—Hiram Barker, St. Joseph, Mo. This invention relates to an improvement in lifting farm gates, providing a short, durable and light gate, in lifting or opening which the pivoted end is made to counterbalance and at one point overbalance the free end, thus rendering the operation of opening the gate very convenient and expeditious.

WIRE FENCE. — John W. Buchanan, Smithville, Ohio. This is a fence in which the wires are secured at one end to a post, chains being attached to the other ends of the wires, and the chains passed through holes in another post at any required distance off, whereby the wires composing the different panels of the fence may be tightened separately, by inserting keys through the links of the chains on the outer side of the distant post.

SPRINKLING CAN.—Alexander P. and Francis M. Baker, Empire, Wis. This is a specially devised can for spraying poisoned solutions on plants and bushes, and is constructed with a readily operated valve by means of which the flow of liquid can be economically controlled, to be applied only where it is needed. The device can also be readily changed to an ordinary water sprinkler.

COFFIN HANDLE. — Lyman E. Woodard, Owosso, Mich. This handle is preferably made of wood, strong and light, and adapted to be conveniently covered by fabric of the same kind as that used to face the exterior of the casket, and with the handle are furnished hinge joints adapted for adjustment to suit different diameters of handle bars, and connect them strongly to the side of the coffin.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JUNE NUMBER.—(No. 68.)

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3. Engravings and floor plans of a double residence on Washington Heights, New York City. Cost $20,000 each. A very picturesque design.
4. A dwelling at New Haven, Conn. Cost $8,000 complete. Perspective view, floor plans, etc.
5. A colonial cottage erected for Mr. C. W. Macfarlane at Elm Station, Pa. Cost $5,300 complete. Floor plans and perspective view.
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7. A picturesque cottage erected for George W. Childs, Esq., in his Villa Park at Wayne, Pa. Cost $7,200 complete. F. H. & W. L. Price, Philadelphia, architects. Plans and perspective.
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9. A row of low cost colonial houses erected at Roseville, N. J. Cost complete $2,000 a house. Plans and perspective view.
10. An English cottage erected at Elm Station, Pa. Cost about $4,000. Perspective and floor plans.
11. Sketch of a farm house recently built in Steuben County, New York, at a cost of $695.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3078) S. J. B. asks for a good patent leather polish for shoes. A. A waterproof blacking which will give a fine polish without rubbing, and will not injure the leather: 18 parts beeswax, 6 parts spermaceti, 66 parts oil of turpentine, 5 parts asphalt varnish, 1 part powdered borax, 5 parts Frankfort black, 2 parts Prussian blue, 1 part nitro-benzol. Melt the wax, add the powdered borax, and stir until a kind of jelly has been formed. In another pan melt the spermaceti, add the asphalt varnish, previously mixed with the oil of turpentine, stir well, and add to the wax. Lastly add the color, previously rubbed smooth with a little of the mass. The nitro-benzol gives fragrance.

(3079) J. P. T.—The ruby jewels can be ground out larger with a hard copper taper wire twirled by the fingers or in a lathe, using diamond dust and oil. The diamond jewels require a steel taper wire with diamond dust and oil.

(3080) G. G. asks (1) if in liquid measure c. c. is an abbreviation for cubic centimeter? A. Yes. 2. How many c. c.'s in one fluid ounce? A. 29·5720. 3. And how many ounces in one liter? A. 33·8160.

(3081) L. S. A. asks: 1. What will clean or polish a marble slab of a soda water fountain which has become rough and dirty by the action of the soda water? A. Use ground pumice stone and water, followed by whiting or putty powder, both applied with a wet woolen cloth, or try following: Mix ¼ pound soft soap with same of whiting in powder, 1 ounce washing soda

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and a piece of copper sulphate as big as a walnut, boil together a few minutes and spread hot over the marble, leave for 24 hours, then wash off and polish with flannel or a piece of felt.

(3082) **J. S. asks for a recipe for taking** indelible ink out of linen. A. A solution of bichloride of mercury (corrosive sublimate) is about the best material for the purpose.

(3083) **C. L. F. asks** (1) **how to make a** a good cheap brass solution. A. Cyanide of potassium 1 pound, cyanide of copper 2 ounces, cyanide of zinc 1 ounce, rain water 1 gallon. Add finally sal ammoniac 2 ounces. Use at 160° F. The color is affected by relative sizes of anode and cathode. Use brass anode. 2. How is fire gilding done? A. Make an amalgam of gold 1 part, mercury 3 parts. Rub it over the perfectly clean surface of the object until coated, expose to a very low red heat, cool, clean with a brush and cream of tartar. A little muriatic acid may be needed in connection with the first application of the amalgam.

(3084) **A. H. asks whether melting** aluminum in a common cast iron ladle has a bad effect on the aluminum, and what it is. A. Plumbago crucibles are recommended. See the SCIENTIFIC AMERICAN, vol. 62, No. 26, for details on manipulation of aluminum.

(3085) **H. F. D. asks: 1. The upturned** edges of rubber soles in tennis shoes peel off from the upper cloth. Please give the proper cement or process for repairing it. A. For treatment of rubber in general see "Rubber Hand Stamps and the Manipulation of Rubber," $1 by mail. A good job cannot be made after manufacture. The soles should be vulcanized in place. 2. Who was the first discoverer of America—Columbus or Leif Erikson? A. The discoveries of Leif Erikson antedated Columbus' voyages by nearly four centuries.

(3086) **W. H. writes: I want to make a** wooden box and divide it into compartments, by means of sheet lead partitions. Required something to line the box, adhering to it and to the edges of the partitions, so as to make each compartment independently acid proof (for a 20 per cent solution of sulphuric acid). It must be an insulator. Should be melted and used hot or as a paste which will harden. Please give me a recipe which does not require special apparatus. A. There are several recipes. One reads thus: Burgundy pitch 150 parts, gutta percha in shreds 25 parts, ground pumice stone 75 parts. Apply hot and melt in with a hot iron. Another reads: Resin 4 parts, gutta percha 1 part, and a little boiled oil. Before applying either composition the cells should be absolutely dry.

(3087) **J. J. McL. asks for** (1) **a receipt** for making extract of lemon. A. Expose 4 ounces lemon rind to the air until partially dry, rub up in a porcelain or glass mortar, agitate with 2 quarts deodorized alcohol until the color is extracted, add 6 ounces freshly made oil of lemons. Let it stand for two days and filter if necessary. The oil is made by distilling water from the rinds; the oil distills over with the steam. 2. One on extract of vanilla. A. Cut 1 ounce vanilla into small pieces, rub up with 2 ounces sugar in a mortar, percolate with 1 pint alcohol, add 1 pint simple sirup. Artificial vanillin is now largely used instead of vanilla beans.

(3088) **F. T. asks how to make phos**phate, such as is used for drinking purposes, in soda water which comes from the fountain on the counter. A. Use 2 drachms phosphoric acid to 1 gallon of simple sirup.

(3089) **M. S. S. asks how to make a fur**niture polish that will make a fine gloss and dry in the shortest possible time. A. Dissolve 4 ounces beeswax in 1 pint turpentine, color with alkanet root if desired. There are many other formulæ; the above is given for its simplicity.

(3090) **W. L. C.—Calcined gypsum or** plaster of Paris is used in the Gassner dry battery.

(3091) **J. A. B. asks what preparation to** use for removing finger spots and other soiled marks from a banjo head without necessitating its removal from the banjo while applying. A. Try bread crumbs, India rubber, or a very smooth piece of pumice stone for bad spots.

(3092) **A. G. asks: 1. What is infusorial** earth? A. Siliceous skeletons of diatoms. These represented a low form of animal life, and infusorial earth is made up of remains of their microscopic skeletons. 2. What are its uses? A. Principally as a polishing agent, as an absorbent for explosives, and in brick and tile and stoneware making. 3. What is its commercial value? A. About $5 per ton. 4. Can sulphate of aluminum be easily and cheaply reduced to merchantable metal? A. No; but it should be of value for the manufacture of alum. 5. Is the Cowles method applicable in reduction of same? A. No.

(3093) **W. H. says: Here is my receipt** for ingrowing toe nails: Soak the foot in warm water for ten or fifteen minutes, then take a medium sized file (a new one, so it is very sharp) and file off the top of nail down as thin as you please; once a week is often enough. I have tried every other known remedy, but this, used for a year, beats them all.

(3094) **P. J. L. asks** (1) **how to deodor**ize kerosene. A. It cannot be completely deodorized. Treatment with concentrated sulphuric acid and bichromate of potash, mixed, may do something, but complete deodorization is not likely to be attained. 2. How to make camphorated oil? A. Dissolve 20 parts camphor in 80 parts cotton seed oil. In China an oil is drained off from the crude camphor, which is termed camphor oil. 3. How to make vaseline. A. By decolorization of petroleum residue with sulphuric acid and bichromate of potash and digestion with bone charcoal.

(3095) **H. B. asks: Is there any differ**ence in the two saccharometers (used in this country for beer worts), Kaiser and Balling, as to degrees? A. They are identical except as regards range. The Kaiser goes up to 40 per cent, the Balling stops at about 10 per cent lower. The reading temperature is 14° Reaumur (63½ Fah.), and the readings correspond to percentages of cane sugar.

(3096) **W. P. B.—The mottling of small** steel work, gun work, etc., is described in Notes and Queries, No. 6, SCIENTIFIC AMERICAN, September 24, 1887.

(3097) **C. O. S. asks for a good and cheap** way for refining lard, so as to get it quite white and able to stand hot climates. A. Cleanliness is the great point in treating lard. The fat is freed from all adhering fleshy or discolored matter by cutting. It is then cut up into small pieces and washed until the water runs off clear. It is next melted by direct fire or steam coil until it becomes perfectly clear. It is run through close linen filters into the barrels, in which it is stirred until white and opaque, but only thickly fluid. The great point is when to cease stirring. It is then cooled and tightly covered. Air makes it rancid. In Brannt's "Animal and Vegetable Fats and Oils," $7.50, and in the same author's "Manufacture of Soap and Candles," $7.50, there is some information on this and allied subjects.

(3098) **R. D.—For the indicated horse** power of a proposed engine: Multiply the proposed horse power by 33,000; divide this product by the mean engine pressure multiplied by the speed of the piston (assigned) in feet per minute; this gives the area of the cylinder in square inches. The mean engine pressure must be assumed from the value of the cut-off, and may be obtained from the steam tables in engineering books. The piston speed may be assumed at any figure between 300 and 400 feet per minute. The length of stroke is arbitrary, from 1½ to twice the diameter of cylinder. The knot is 1·151 miles. Fastest trains about 60 miles per hour. Driving wheels 6 feet 6 inches diameter. Special locomotives may have driving wheels larger. A rate of 80 to 90 miles an hour is probably the maximum velocity a locomotive could run.

(3099) **B. C. writes: I have a guitar that** has got some grease or oil spots of a dark color on the face of the instrument. Can you tell me what and how to remove them without injuring the sound or tone of the guitar? A. Fuller's earth mixed to a cream with benzine and placed in a thick layer over the spots, and allowed to dry, may draw out some of the grease. But there will be danger of injuring your instrument by the benzine acting on the varnish.

(3100) **S. D. asks: 1. How can we purify** natural gas so as to use it for lighting? It burns with a blue blaze with great heat, but does not give much light. A. Carbureting with gasoline will effect your purpose; no purifying is needed. Possibly passing through slaked lime would help it. 2. Will natural gas run a gas engine as well as coal gas? A. Not generally, and in your case certainly not. 3. Our gas well has a steady flow, but the gas will not burn at all times. What is the cause? A. Your gas evidently varies in composition. When it will not burn, it is because it contains probably too much nitrogen.

(3101) **H. V. asks: 1. Can the smoke** from zinc ore roasting furnaces profitably be worked up for sulphuric acid? A. There is no reason why it should not, except that the percentage of sulphur is low, and if the roasting is effected with fuel there will be too much organic matter in the fumes to make it profitable. 2. What effect will the smoke of 50 such furnaces in a city of 10,000 inhabitants in the course of time have on health? You know that it kills all vegetation for quite a distance. A. We should not anticipate much, if any, injury to health.

(3102) **E. asks: What chemicals or acids** united to phosphorus will produce a constant glow in an air-tight bottle? A. The nearest approach to what you ask is Balmain's luminous paint, described in our SUPPLEMENT in several places. A solution of phosphorus in olive oil will glow after exposure to the air.

(3103) **W. McC.—Gun barrels and other** parts are properly blued by finishing of an even or polish grain, and heating until the proper color is obtained. For amateur work a brown stain may be made on the clean and polished barrel by brushing with a mixture of protochloride of antimony 1 part, nitric acid 1 part, hydrochloric acid 2 parts. Add the hydrochloric acid very slowly to prevent ebullition. Apply to the surface of the metal with a woolen rag and rub the surface with green young oak wood until the desired brown color is obtained. Wash with warm water, dry, and wipe with boiled linseed oil.

(3104) **S. E. B. asks: Can you give me a** receipt for treating oak and giving it a 16th century finish? Also a receipt for treating iron, such as grates, fenders, etc., giving the same an old iron finish? A. Oak may be given the appearance of age by sponging with sulphuric acid and water equal parts, or what is preferable staining with umber in thin shellac varnish. Iron work may be treated with a wash of sulphate of soda and heating over a fire, or by brushing a solution of flour sulphur in 10 parts of turpentine, dissolved by heating, over the irons, then holding them over an alcohol lamp; heat until the black polish appears.

(3105) **F. D. S. says: I wish to use the** power of a fall of 30 feet of water delivered through an iron pipe 2 feet in diameter and 70 feet long. *a*. What size turbine should I use? *b*. How much useful power would I obtain? *c*. What would be the rate of flow from the end? A. If you have a full supply at the head of your pipe, it will deliver over 8,000 cubic feet of water at the mouth per minute. If you are sure that you have this quantity of water supply, you may realize 225 horse power with a 48 inch turbine of good make, or equal to the Leffel wheels.

(3106) **W. H. S.—To polish rubber, the** hard rubber should be turned as smooth as possible. Then finish with the finest sand paper or flour emery paper. Then polish with a paste of oxide of tin (putty powder) and water on a cloth.

(3107) **W. McL. asks if it is practicable** to exhaust steam from engine and heaters into smoke stack. A. If there is a necessity for a stronger draught than the natural draught of the stack, a well arranged jet exhaust is practical and advantageous. The outlet or nozzle of the exhaust should be about four diameters of the stack below the top and in the center for best effect. If not needed for draught, and the stack is large enough and draught strong enough to overcome the choking by the volume of steam, it is practicable, if convenient, for iron chimneys. Brick chimneys should be kept free from steam under all circumstances.

(3108) **A. K. F.—The frying sound in the** telephone is caused by induction from other lines, earth currents and static discharges. To increase the volume of sound in a magneto telephone, use a carbon transmitter.

(3109) **J. C. P. asks for latest method of** determining by simple process, suitable for high school laboratory, the presence of arsenic in wall papers, etc. A. By simple burning the garlic-like odor of arsenic can be detected if arsenic is present in large quantities. If chemically pure zinc and sulphuric acid are obtainable, Marsh's test is best. It is given in all analytical chemistries, such as Shepard's "Inorganic Chemistry," $1.50.

(3110) **H. H. asks: Where is the Henne**pin Canal? A. In Illinois. It extends from the Illinois River at the town of Hennepin to the Mississippi River near Rock Island. It forms part of the waterway intended to connect Lake Michigan with the Father of Waters.

(3111) **E. G. W. asks: What do you con**sider the highest surface speed (with reference to friction) in feet per minute at which iron forged shafting may safely run in babbitt boxes without danger of melting the babbitt, provided the best known lubricating oil is used? A. We have no information as to the extreme limit of friction or speed necessary to melt babbitt metal, both the lubricant and babbitt metal being of uncertain value. The severest trial of frictional value is on a fast railroad train, where a journal speed of 800 feet a minute has been attained on short runs. In ordinary machinery 400 to 500 feet per minute can be obtained with safety from overheating. As a general rule the percentage of friction due to load decreases with an increase of velocity. See chapters on friction in Trautwine's "Engineer's Pocket Book," $5 mailed.

(3112) **W. S. S. asks: Kindly give the** weighs for cord of granite, lime, and sandstone. A. No definite weight can be given. Each kind of stone varies in different localities. If you mean broken stone, an approximate answer only can be given, granite 2,700 pounds, limestone 2,600 pounds, sandstone 2,400 pounds per cord. These figures will vary from 100 to 200 pounds, according to locality and condition.

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June 9, 1891,

AND EACH BEARING THAT DATE.

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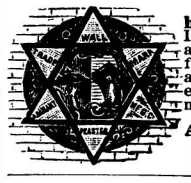

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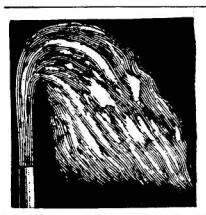

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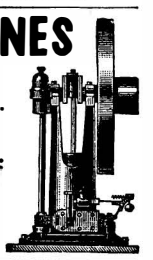

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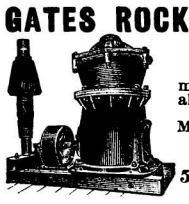

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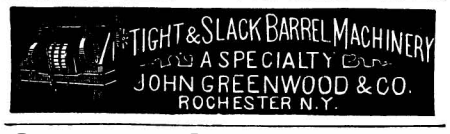

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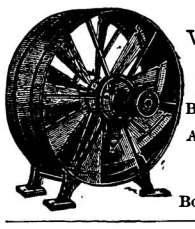

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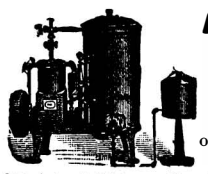

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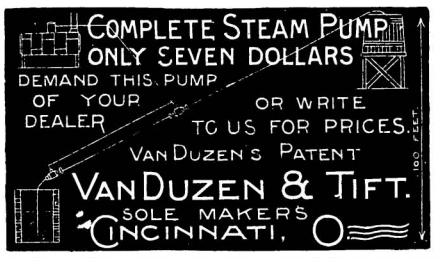

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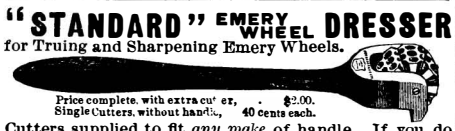

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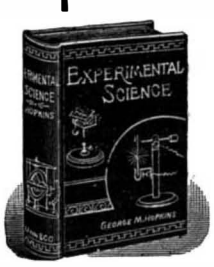

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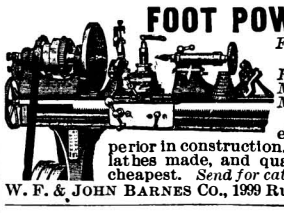

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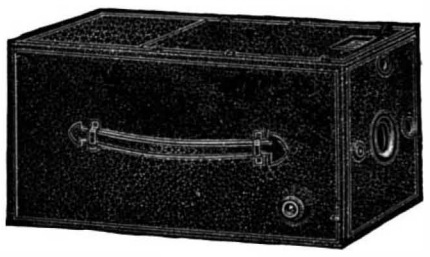

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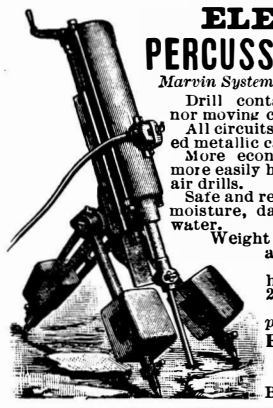

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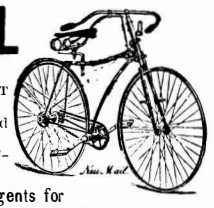

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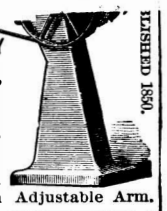

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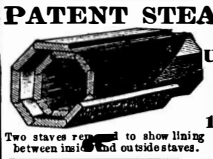

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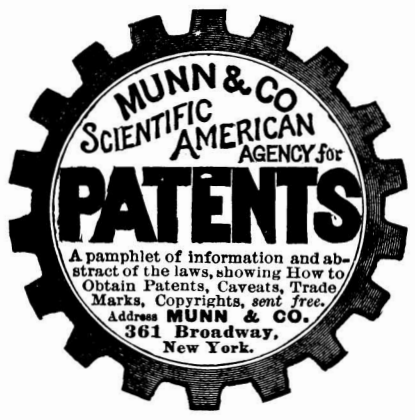
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